Lower Passaic River Study Area

River Mile 10.9 Characterization Addendum D

Sediment Collection to Support Removal Action Design and Dredge Material Characterization

February 2013

Revision 1

Approved By: _____ Date: February 12, 2013
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Introduction

This document is an addendum to the *RM 10.9 Lower Passaic River Study Area River Mile 10.9 Characterization QAPP*, Revision 3, dated October 21, 2011 (AECOM 2011; hereafter referred to as the 2011 RM 10.9 QAPP) and includes that document by reference. This Quality Assurance Project Plan (QAPP) Addendum outlines the additional tasks associated with the River Mile (RM) 10.9 characterization program and includes sample collection, sample processing, and analytical procedures to support the RM 10.9 Removal Action design and to characterize the dredge area sediments for future disposal at an offsite upland landfill. All samples will be collected from the RM 10.9 Removal Area, located in the Lower Passaic River Study Area (LPRSA). Associated Quality Assurance (QA) and Quality Control (QC) activities developed for this program have also been included in this QAPP Addendum.

Table 1 provides a key to the 2011 RM 10.9 QAPP and this Addendum and includes the following:

- Worksheets that are included by reference as written in the 2011 RM 10.9 QAPP (i.e., not revised for this addendum and not included in this addendum);
- Worksheets that are included by reference, but with changes (e.g., removal of specific analytes) (only changes are included in this addendum); and,
- Worksheets that are revised and included in this addendum.

In addition to the QAPP worksheets, this addendum includes an introduction (this section) and additional laboratory SOPs as Appendix A.

Background Information

The LPRSA encompasses the 17.4-mile tidal reach of the Passaic River below the Dundee Dam, its tributaries, and the surrounding watershed that hydrologically drains below the Dundee Dam. Overall goals of the Remedial Investigation/Feasibility Study (RI/FS) and a description of the associated investigations have been presented in the Work Plan (Malcolm Pirnie, Inc [MPI] 2005), three Field Sampling Plans (FSP) (FSP1 [MPI 2006], FSP2 [MPI 2006], and FSP3 [MPI 2005]), and a QAPP (MPI 2005).

In April 2011, the Cooperating Parties Group (CPG) agreed to undertake additional sampling and data collection to characterize an approximately 8.9 acre deposit of sediments located near RM 10.9. The general scope of the characterization effort included sample collection (i.e., sediment cores), sample analysis, and a bathymetry survey. This work was performed in accordance with the 2011 RM 10.9 QAPP. In addition, a hydrodynamic study was performed in accordance with the *River Mile 10.9 Hydrodynamic Field Investigation Quality Assurance Project Plan for the Lower Passaic River, Lower Passaic River Restoration Project*, October 2011, Revision 2 (AECOM 2011). As part of the RM 10.9 Administrative Order on Consent (RM 10.9 AOC; USEPA 2012), the CPG has agreed to the removal and capping of approximately 18,000 cubic yards (cy) of sediments.

Table 1. QAPP Worksheet Key

Worksheet No.	Worksheet Title	RM 10.9 QAPP Worksheets			RM 10.9 QAPP Addendum D Worksheet
		No Changes	Changes - Additions	Changes - Exclusions	
1	Title and Approval Page				Replacement
2	QAPP Identifying Information				Replacement
3	Distribution List		Added CH2M HILL RM 10.9 Addendum D Task Manager and CH2M HILL Project Manager		Changes only
4	Project Personnel Sign-Off Sheet		Added CH2M HILL RM 10.9 Addendum D Task Manager and CH2M HILL Project Manager		Changes only
5	Project Organizational Chart				Replacement
6	Communication Pathways				Replacement
7	Personnel Responsibilities and Qualifications Table				Replacement
8	Special Personnel Training Requirements Table	X			See 2011 RM 10.9 QAPP Worksheet
9	Project Scoping Session Participants Sheet		Added Addendum D Scoping Sessions		Changes Only
10	Problem Definition				Replacement
11	Project Quality Objectives/Systematic Planning Process Statements				Replacement
12	Measurement Performance Criteria Table		Information for aqueous samples added	Addendum target analytes only	Changes Only
13	Secondary Data Criteria and Limitations Table		Added information regarding data usage		Changes Only
14	Summary of Project Tasks				Replacement
15	Reference Limits and Evaluation Table		Information for aqueous samples added	Addendum target analytes only	Changes Only

16	Project Schedule/Timeline Table				Replacement
17	Sampling Design and Rationale				Replacement
18	Sampling Locations and Methods/SOP Requirements Table				Replacement
19	Analytical SOP Requirements Table		Information for aqueous samples added	Addendum target analytes only	Changes Only
20	Field Quality Control Sample Summary Table				Replacement
21	Project Sampling SOP Reference Table				Changes only
22	Field Equipment	X			See RM 10.9 QAPP Worksheet
23	Analytical SOP Reference Table		Information for aqueous samples added. Analysis of methyl mercury added.	Addendum target analytes only	Changes Only
24	Analytical Instrument Calibration Table		Information for aqueous samples added Information analysis of mercury species added	Addendum target analytes only	Changes Only
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table		Information for aqueous samples added Information analysis of mercury species added	Addendum target analytes only	Changes Only
26	Sample Handling System		Revisions to reflect collection, shipping and handling		Changes Only
27	Sample Custody Requirements		Added sample nomenclature for samples		Changes only
28	QC Samples Table		Information for aqueous samples added	Addendum target analytes only	Changes Only
29	Project Documents and Records Table				Changes Only

30	Analytical Services Table		Information for aqueous samples added. Added mercury speciation parameters	Addendum target analytes only	Changes Only
31	Planned Project Assessment Table			Safety and technical audits and PE samples not applicable	See RM 10.9 QAPP Worksheet
32	Assessment Findings and Response Actions			Safety and technical audits and PE samples not applicable	See RM 10.9 QAPP Worksheet
33	QA Management Reports Table	X			See RM 10.9 QAPP Worksheet
34	Sampling and Analysis Verification (Step I) Process Table	X			See RM 10.9 QAPP Worksheet
35	Sampling and Analysis Validation (Steps IIa and IIb) Process Table		Updated validation steps added		Replacement
36	Sampling and Analysis Validation (Steps IIa and IIb) Summary Table	X			See RM 10.9 QAPP Worksheet
37	Data Usability Assessment				Replacement

Sampling Objectives

The objectives of the sediment sampling proposed in this RM 10.9 QAPP Addendum are to collect additional site-specific data for incorporation into the numerical model used to support the cap design and to characterize the dredge area sediments for future disposal at an offsite upland landfill. The activities to be performed include:

- Pore Water Characterization: Collect high concentration sediment cores from the RM 10.9 Removal Area for analysis of pore water concentrations of select constituents of potential concern (COPCs). Sediment cores will be sent intact from the field to a designated laboratory for extraction of pore water via centrifugation and subsequent chemical analysis of the pore water.

- Mercury Treatability Studies: Collect high concentration sediment cores from the RM 10.9 Removal Area for potential mercury treatability studies. These studies include batch kinetic and isotherm experiments to evaluate the performance of activated carbon and organoclay for mercury and methyl mercury. Sediment cores will be stored frozen at a designated laboratory.

- Stabilization Treatability Studies: Collect representative sediment cores from the RM 10.9 Removal Area for stabilization treatability studies. These studies will determine the optimal dose of Portland cement needed to stabilize RM 10.9 dredged material so it can be transported and meet the acceptance criteria of the designated offsite disposal facility and ensure the stabilized end-product meets TCLP criteria.

- Toxicity Characteristic Leaching Procedure (TCLP) Characterization: Collect representative sediment cores from the RM 10.9 Removal Area for TCLP analyses to support future disposal of the dredge material.

- Sediment Contaminant Characterization: A subset of the cores characterized for TCLP will also be submitted for analysis of dibenzodioxins/polychlorinated dibenzofurans (PCDDs/PCDFs), polychlorinated biphenyls (PCBs), and mercury.

Sampling and Analysis Approach

The field sampling activities and analytical program presented in this QAPP Addendum include sediment and pore water sampling. The sampling program is detailed in Table 2.

A boat-based vibracore system (or piston push core) will be used to collect the sediment cores. A push corer may be used, if more appropriate, based on the sediment encountered. The maximum target depth for sample collection is 4 ft and the sampler will be advanced an additional 1 ft to provide a plug to keep the sample in the sampler. The drilling and sampling will be conducted under the direct supervision of a geologist or geotechnical engineer.

After collection, intact sediment cores will be cut, capped and sealed. A total of 50 sediment core segments (2 – 4 ft interval) will be processed for pore water characterization, 10 sediment core segments (2 – 4 ft interval) will be stored for potential mercury treatability studies, 26 sediment core segments (0 – 2 ft interval) will used in the stabilization treatability studies, 25 sediment core segments (0 – 2 ft interval) will be individually composited in the field and shipped to the designated commercial laboratory for TCLP characterization, and 6 of the 25 TCLP sediment cores will also be submitted for characterization of PCDD/PCDFs, PCBs and Mercury. CH2M HILL's Applied Science Laboratory (ASL) will be extracting pore water for subsequent analysis of organic COPCs by the LPR contract laboratories. Sediment cores will be sent directly from the field to Brooks Rand, LLC for extraction and analysis of mercury and methyl mercury. Sediment core collection is expected to occur over a two-week period and the sample processing (pore water extraction) is expected to be completed within one week.

Table 2. Summary of Proposed Sediment Cores

			Organic Pore Water	Mercury Pore Water	Mercury Treatability	Stabilization Treatability	TCLP Chacterization	Sediment COPC Characterization	Excess Sediment
Total No. 2-ft Core Segments			44	6	10	26	25	6 of the 25 TCLP Cores	21
Location	No. Cores (total depth interval)	Core Segment	Cap ends, send to ASL for pore water extraction	Cap ends, send to Brooks Rand for pore water extraction	Cap ends, send to ASL for storage	Composite for vendor pickup	Composite, prepare samples for TCLP/COPC characterization, and send to designated laboratories for analysis		Place in drums for disposal
RM10.9D-0312	2 (0 - 4 ft)	0 - 2 ft					1		1
		2 - 4 ft	2						
RM10.9D-0314	5 (0 - 4 ft)	0 - 2 ft				4	1		
		2 - 4 ft	4		1				
RM10.9D-0316	2 (0 - 4 ft)	0 - 2 ft					1		1
		2 - 4 ft	2						
RM10.9D-0318	5 (0 - 4 ft)	0 - 2 ft				4	1		
		2 - 4 ft	4		1				
RM10.9D-0322	5 (0 - 4 ft)	0 - 2 ft					1		4
		2 - 4 ft	4		1				
RM10.9D-0333	7 (0 - 4 ft)	0 - 2 ft				3	1		3
		2 - 4 ft	4	2	1				
RM10.9D-0338	7 (0 - 4 ft)	0 - 2 ft				3	1		3
		2 - 4 ft	4	2	1				
RM10.9D-0339	5 (0 - 4 ft)	0 - 2 ft				3	1		1
		2 - 4 ft	4		1				
RM10.9D-0340	4 (0 - 4 ft)	0 - 2 ft					1		3
		2 - 4 ft	4						
RM10.9D-0343	5 (0 - 4 ft)	0 - 2 ft				3	1		1
		2 - 4 ft	4		1				
RM10.9D-0344	5 (0 - 4 ft)	0 - 2 ft				3	1		1
		2 - 4 ft	4		1				
RM10.9D-0350	1 (0 - 4 ft)	0 - 2 ft					1		
		2 - 4 ft			1				
RM10.9D-0351	7 (0 - 4 ft)	0 - 2 ft				3	1		3
		2 - 4 ft	4	2	1				
RM10.9D-T01	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T02	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T03	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T04	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T05	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T06	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T07	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T08	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T09	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T10	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T11	1 (0 - 2 ft)	0 - 2 ft					1		
RM10.9D-T12	1 (0 - 2 ft)	0 - 2 ft					1		

Note: Table entries indicate number of separate planned cores at each location and depth interval. See QAPP text and worksheets for core compositing strategy.

Sediment Sampling Locations

The sediment sampling locations are shown in Figure 1 and comprise 25 separate locations within the RM 10.9 Removal Area. A total of 72 sediment cores (4" diameter) will be collected and appropriately segmented to obtain the required number of cores for each of the sampling objectives. Details of how many sediment cores will be collected from each location and how each core will be handled are discussed in this section followed by a discussion of location selection (see Tables 3 and 4).

- Pore Water Characterization: The proposed number of cores will provide sufficient sediment volume to prepare two composite pore water samples. If excess pore water is present after the preparation of the primary composite samples, it will be used to generate "field duplicate" samples. In addition, the laboratories will be instructed to prepare "laboratory duplicate" samples with any pore water remaining after the analysis of the primary (and field duplicate, if generated) samples.

  Organic COCPs - A total of 44 sediment cores (2 – 4 ft depth interval) will be collected from 12 separate sampling locations within the proposed extent of the cap to capture the highest concentrations of PCDDs/PCDFs and PCBs. The 44 sediment cores will be divided into two separate groups to produce a total of two pore water composite samples (one composite sample per each group of 22 sediment cores), as shown on Figure 2 and Table 5.

  Mercury - A total of 6 sediment cores (2 – 4 ft depth interval) will be collected from 3 separate sampling locations within the proposed extent of the cap to capture the highest concentrations of mercury. The 6 sediment cores will be divided into two separate groups to produce a total of two pore water composite samples (one composite sample per each group of 3 sediment cores per composite sample), as shown on Figure 3 and Table 6.

- Mercury Treatability Studies: Ten (10) sediment cores (2 – 4 ft depth interval) from the 10 highest mercury locations will be collected and stored frozen for potential mercury treatability studies, as shown on Figure 4 and Table 7.

Each of the sediment cores collected above will be 4 feet (ft) long, however only the bottom 2-ft interval (2 - 4 ft depth interval) will be used for the pore water characterization and potential mercury treatability studies. The top 2-ft interval (0 – 2 ft) from many of these sediment cores will be used for either TCLP characterization or stabilization treatability tests as discussed in the next two bullets.

- Stabilization Treatability Studies: A total of 26 sediment cores (0 – 2 ft depth interval) will be collected for use in the stabilization treatability studies. The core locations are shown on Figure 5 and Table 8.
- TCLP Characterization: A total of 25 sediment cores (0 – 2 ft depth interval) will be individually composited over their entire core length and characterized for TCLP. The TCLP characterization core locations are shown on Figure 6 and Table 9.
- Sediment Contaminant Characterization: Six of the 25 TCLP sediment cores (0 – 2 ft depth interval) will also be characterized for contaminants in sediment as indicated in Worksheet #11. These 6 locations have been selected and located to provide additional characterization throughout the extent of the Removal Area. The sediment contaminant characterization core locations are shown on Figure 6 and Table 9.

Sediment Core Location Selection

Sediment core locations for pore water characterization were selected to correspond to the locations with the 10 highest concentrations of PCDDs/PCDFs, PCBs, and mercury encountered in the sediment within the 2 to 4 ft depth interval, as determined during the 2011 RM 10.9 Characterization Program. These locations also include 9 of the top 10 high molecular weight (HMW) polycyclic aromatic hydrocarbon (PAH) and 8 of the top 10 low molecular weight (LMW) PAH locations. To select these locations, an average concentration within the 1.5 to 3.5 ft interval for each of the select COPCs (PCDDs/PCDFs, PCBs, PAHs, and mercury) was calculated for the 25 locations within the cap area. Data from the 1.5 to 3.5 ft interval, which was collected during the 2011 RM 10.9 Characterization Program, are representative of the 2 to 4 ft interval of sediment remaining after dredging. These sediments will be capped after dredging. Each location and COPC was then ranked from 1 as the highest average concentration to 25 as the lowest average concentration. The results are presented in Tables 3 and 4 for mercury and the organic COPCs, respectively. Since the top 10 locations for mercury and organic contaminants were not all co-located, the sampling program includes a total of 13 separate locations (rather than 10) for the collection of sediments for pore water characterization.

To obtain both the required number of samples and adequate spatial coverage of the Removal Area for disposal purposes, sediment core locations for TCLP characterization include: 1) locations previously characterized for sediment contaminant concentrations and 2) locations in areas outside those previously characterized. Of the 25 TCLP core locations, 6 were selected for spatial distribution over the Removal Area for additional contaminant characterization.

Table 3. Top 10 Core Rankings for Mercury within the Cap Area (1.5 to 3.5 ft interval)

Core Location	Mercury Conc (ppm)	Core Rank	TOC (%)
11B-0351	19.8	1	8.9
11B-0338	18.4	2	7.0
11B-0333	16.7	3	8.7
11B-0314	16.5	4	7.9
11B-0343	15.0	5	7.8
11B-0344	14.9	6	7.9
11B-0339	14.0	7	7.5
11B-0350	13.9	8	4.7
11B-0322	13.6	9	8.4
11B-0318	11.5	10	7.9

TOC = Total Organic Carbon
ppm = parts per million

Table 4. Top 10 Core Rankings for PCDDs/PCDFs, PCBs, and PAHs within the Cap Area (1.5 to 3.5 ft interval)

Core Location	2,3,7,8-TCDD Conc (ppt)	Core Rank	Total PCB Conc (ppm)	Core Rank	HMW PAH Conc (ppm)	Core Rank	LMW PAH Conc (ppm)	Core Rank	TOC (%)
11B-0344	30150	1	1	15	49.1	7	13.0	2	7.9
11B-0339	26600	2	21	7	53.3	5	10.3	6	7.5
11B-0343	21800	3	24	4	51.2	6	9.6	11	7.8
11B-0351	21000	4	1	18	37.4	13	9.1	13	8.9
11B-0333	20450	5	27	1	54.6	3	10.2	8	8.7
11B-0318	19350	6	23	5	48.8	8	12.1	4	7.9
11B-0340	17550	7	17	8	46.3	9	9.3	12	7.1
11B-0338	16850	8	25	2	54.5	4	10.3	6	7.0
11B-0322	16650	9	22	6	44.1	11	9.8	10	8.4
11B-0314	16225	10	24	3	55.4	2	12.6	3	7.9
11B-0316	8078	13	12	9	60.5	1	13.5	1	6.0
11B-0312	1025	16	9	10	24.7	18	6.2	17	7.5

HMW PAH = high molecular weight polycyclic aromatic hydrocarbons
LMW PAH = low molecular weight polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
ppm = parts per million
ppt = parts per trillion
TCDD= tetrachlorodibenzo-p-dioxin
TOC = total organic carbon

Sample Analysis: Upon receipt of the sediment cores, the laboratories will centrifuge the cores to separate the pore water from the sediment particles.[1] ASL will process the core segments designated for characterization of organic COPCs. These sediment cores will be divided as discussed above and pore water will be composited into two samples and sent to the appropriate LPR contract laboratories for analysis of PCDDs/PCDFs, PCBs (homologs and congeners), PAHs, total organic carbon (TOC), and dissolved organic carbon (DOC). Brooks Rand, LLC will centrifuge sediments for extraction and analysis of two pore water composite samples for low-level total mercury and methyl mercury.[2] The cores that have been identified for TCLP analysis will be composited in the field and tested for the following parameters: TCLP SVOCs, TCLP pesticides, TCLP herbicides, TCLP mercury, and TCLP metals. The RM 10.9 QAPP Addendum D analytical parameters will be analyzed using the same methods, and by the same laboratories, as specified in the 2011 RM 10.9 QAPP.

1 The centrifuge spin time and speed are based on each laboratory's experience with other samples and previous pore water extractions. Centrifuge containers are visually inspected upon removal from the centrifuge for separation. If proper separation is not observed, the sample will be centrifuged a second time.

2 Brooks Rand indicated that pore water extracted for analysis of dissolved mercury species is filtered through a 0.45 um filter. Note that both total and dissolved mercury and methyl mercury will be analyzed in the pore water.

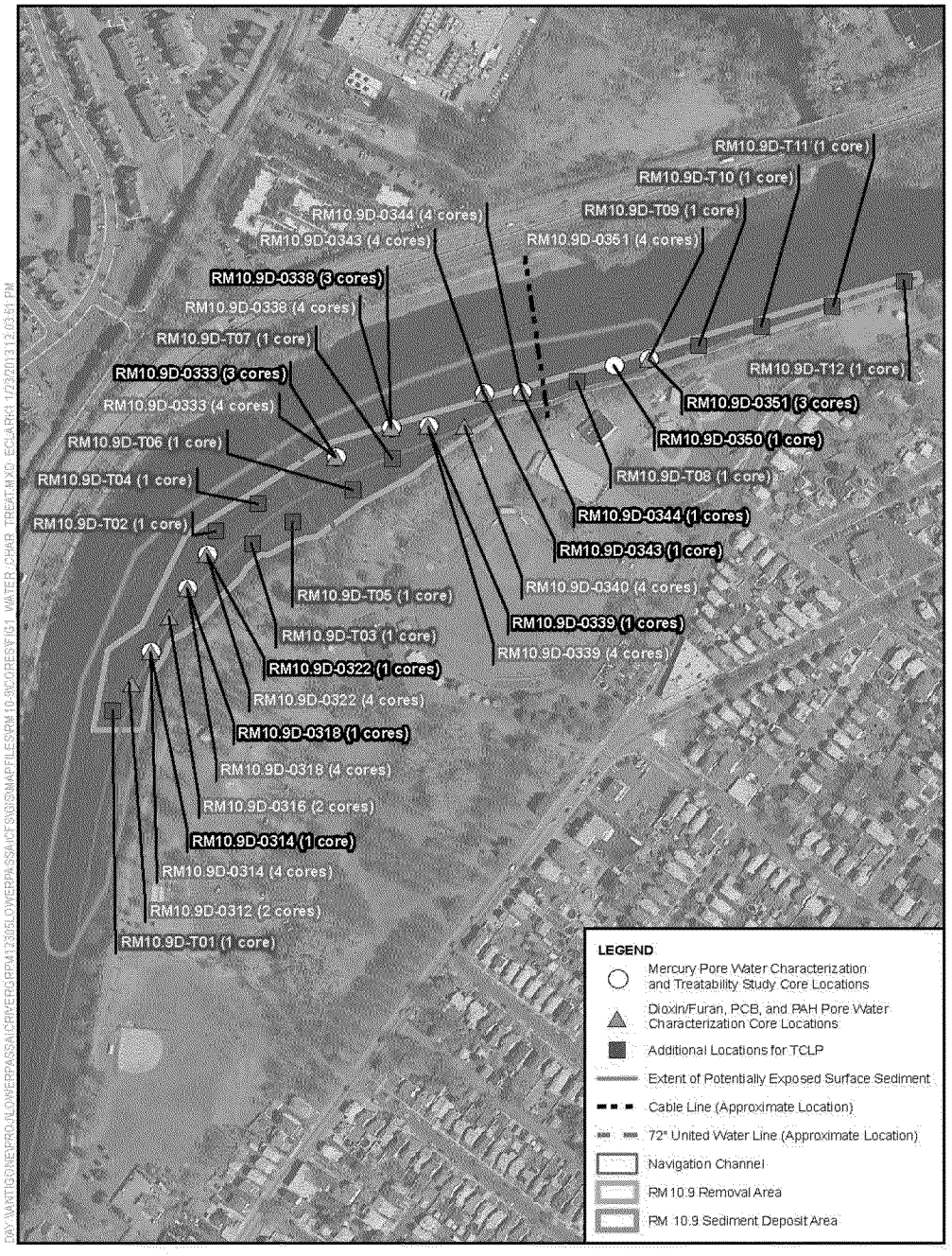

FIGURE 1
Core Location Map
Lower Passaic River Study Area, New Jersey

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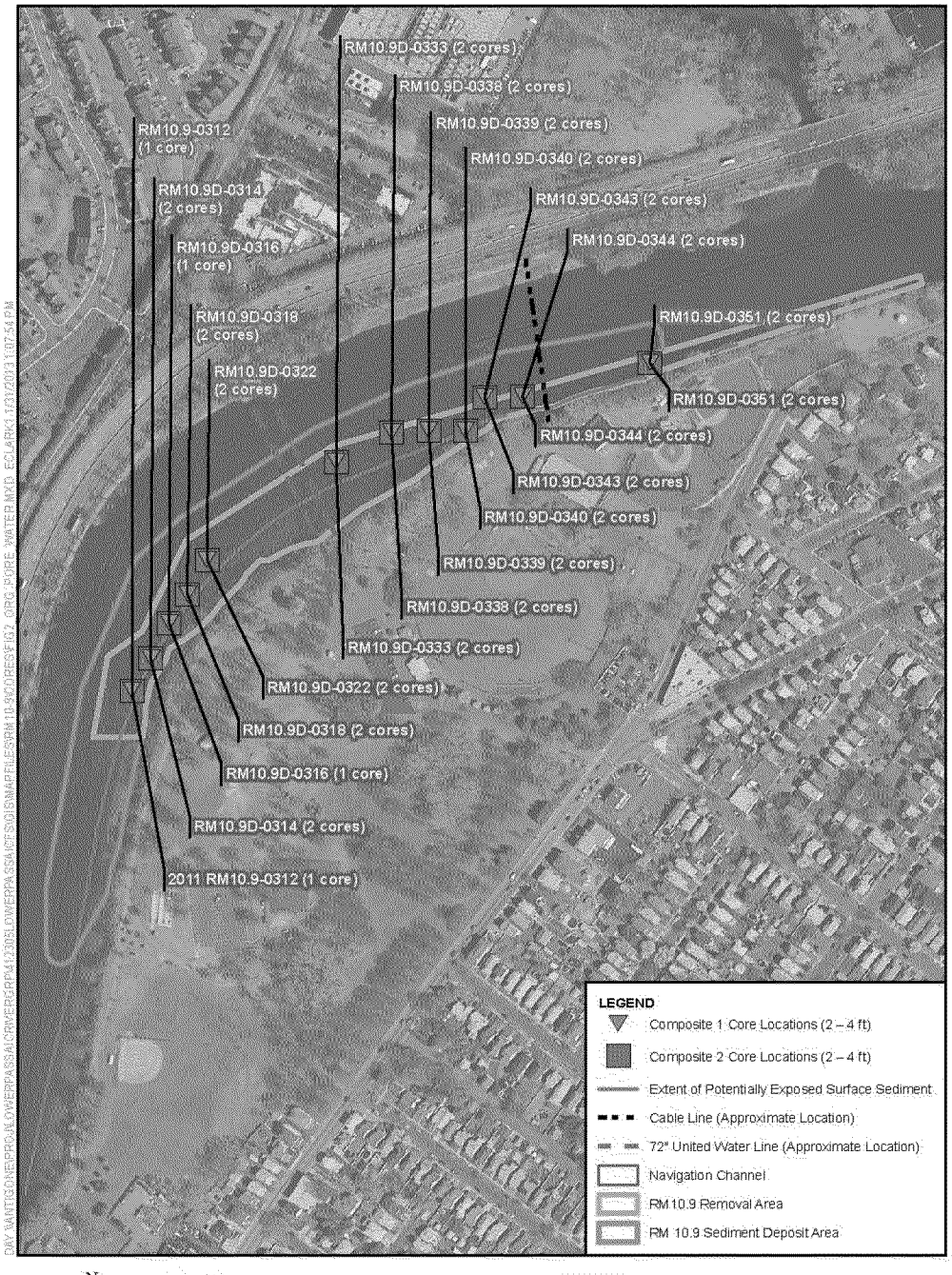

Notes:
1. Orthophoto: NJGIS, 2007
2. The Extent of Potentially Exposed Surface Sediment was generated from the -2ft (NGVD29) elevation, which represents the Mean Low Water for this part of the river. The data source was the July 2011 Bathymetry Survey conducted as part of the RM 10.9 Characterization Program (CH2M HILL & AECOM, 2012).

FIGURE 2
Organic Pore Water Composite Core Locations
Lower Passaic River Study Area, New Jersey

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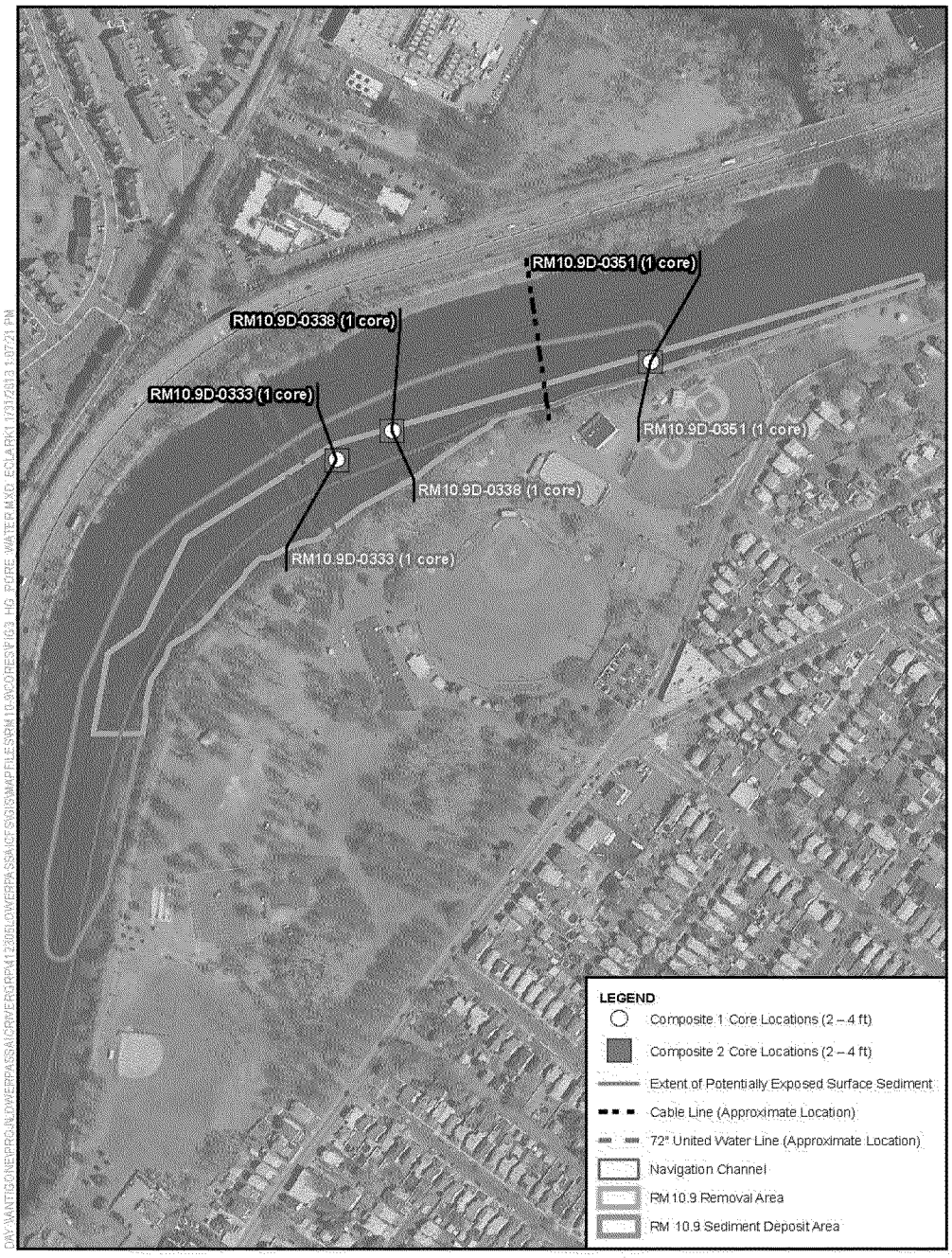
Table 5. Sediment Core Segments for Organic Pore Water Extraction

Total Core Segments		22	22
Location	No. Cores (depth interval)	Organic COPC Pore Water Composite 1	Organic COPC Pore Water Composite 2
RM10.9D-0312	2 (2 - 4 ft)	1	1
RM10.9D-0314	4 (2 - 4 ft)	2	2
RM10.9D-0316	2 (2 - 4 ft)	1	1
RM10.9D-0318	4 (2 - 4 ft)	2	2
RM10.9D-0322	4 (2 - 4 ft)	2	2
RM10.9D-0333	4 (2 - 4 ft)	2	2
RM10.9D-0338	4 (2 - 4 ft)	2	2
RM10.9D-0339	4 (2 - 4 ft)	2	2
RM10.9D-0340	4 (2 - 4 ft)	2	2
RM10.9D-0343	4 (2 - 4 ft)	2	2
RM10.9D-0344	4 (2 - 4 ft)	2	2
RM10.9D-0351	4 (2 - 4 ft)	2	2



Notes:
1. Orthophoto: NJGIS, 2007
2. The Extent of Potentially Exposed Surface Sediment was generated from the -2ft (NGVD29) elevation, which represents the Mean Low Water for this part of the river. The data source was the July 2011 Bathymetry Survey conducted as part of the RM 10.9 Characterization Program (CH2M HILL & AECOM, 2012).

FIGURE 3
Mercury Pore Water Composite Core Locations
Lower Passaic River Study Area, New Jersey

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Table 6. Sediment Core Segments for Mercury Pore Water Extraction

Total Core Segments		3	3
Location	No. Cores (depth interval)	Organic COPC Pore Water Composite 1	Organic COPC Pore Water Composite 2
RM10.9D-0333	2 (2 - 4 ft)	1	1
RM10.9D-0338	2 (2 - 4 ft)	1	1
RM10.9D-0351	2 (2 - 4 ft)	1	1

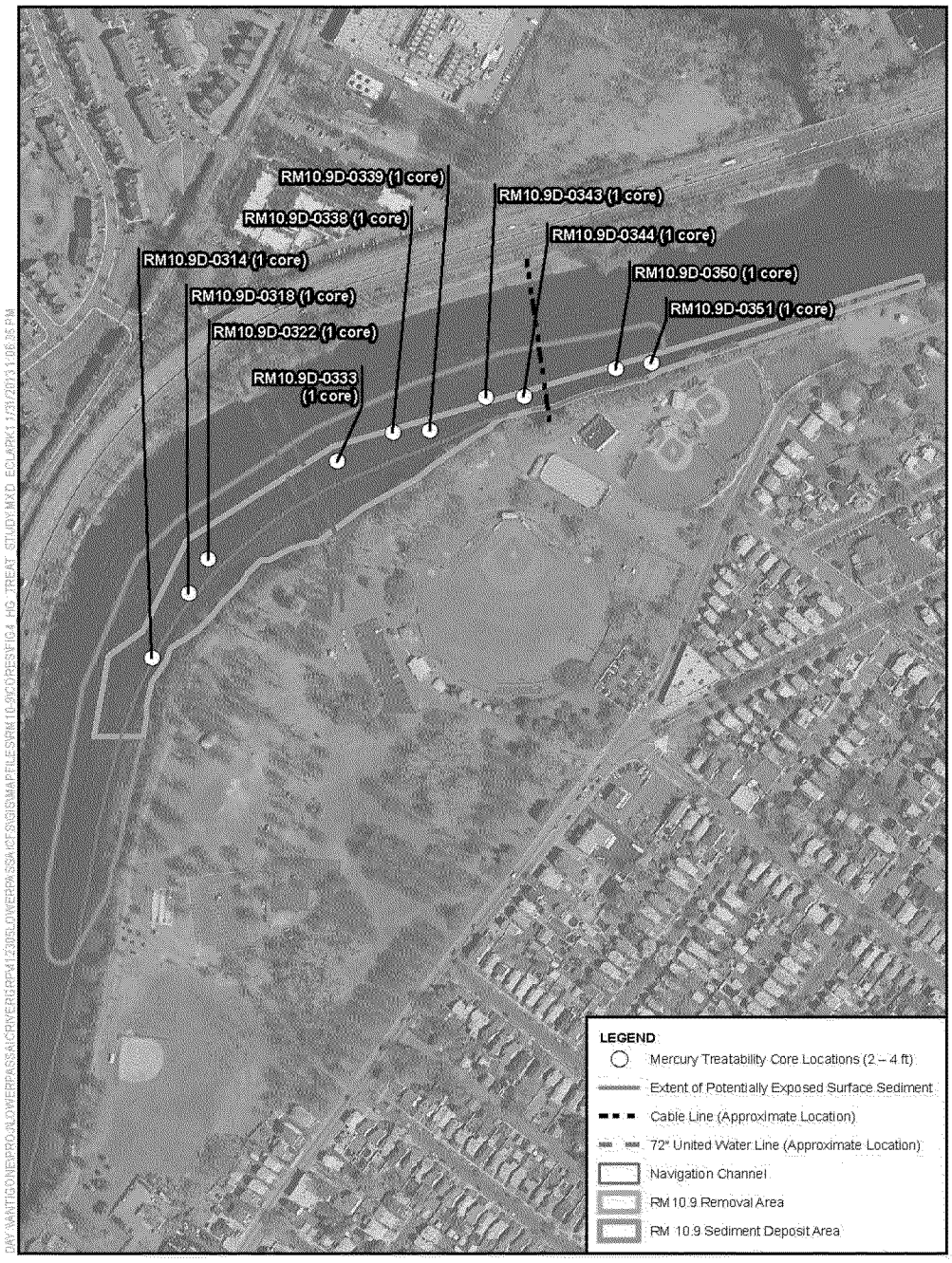

FIGURE 4
Mercury Treatability Study Core Locations
Lower Passaic River Study Area, New Jersey

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Table 7. Sediment Core Segments for Mercury Treatability Study

Total Core Segments		10
Location	No. Cores (depth interval)	Cores to be stored frozen
RM10.9D-0314	1 (2 - 4 ft)	1
RM10.9D-0318	1 (2 - 4 ft)	1
RM10.9D-0322	1 (2 - 4 ft)	1
RM10.9D-0333	1 (2 - 4 ft)	1
RM10.9D-0338	1 (2 - 4 ft)	1
RM10.9D-0339	1 (2 - 4 ft)	1
RM10.9D-0343	1 (2 - 4 ft)	1
RM10.9D-0344	1 (2 - 4 ft)	1
RM10.9D-0350	1 (2 - 4 ft)	1
RM10.9D-0351	1 (2 - 4 ft)	1

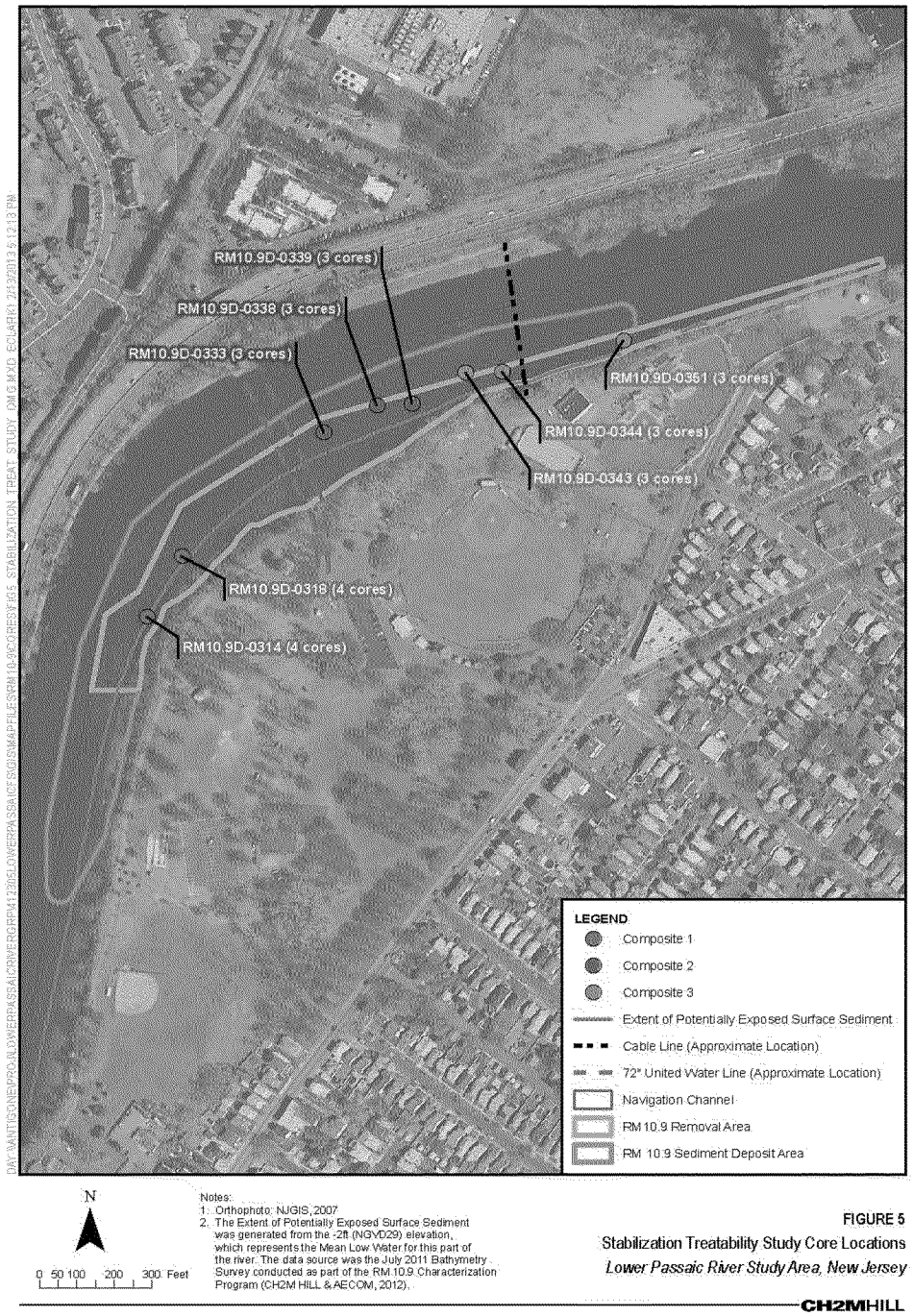
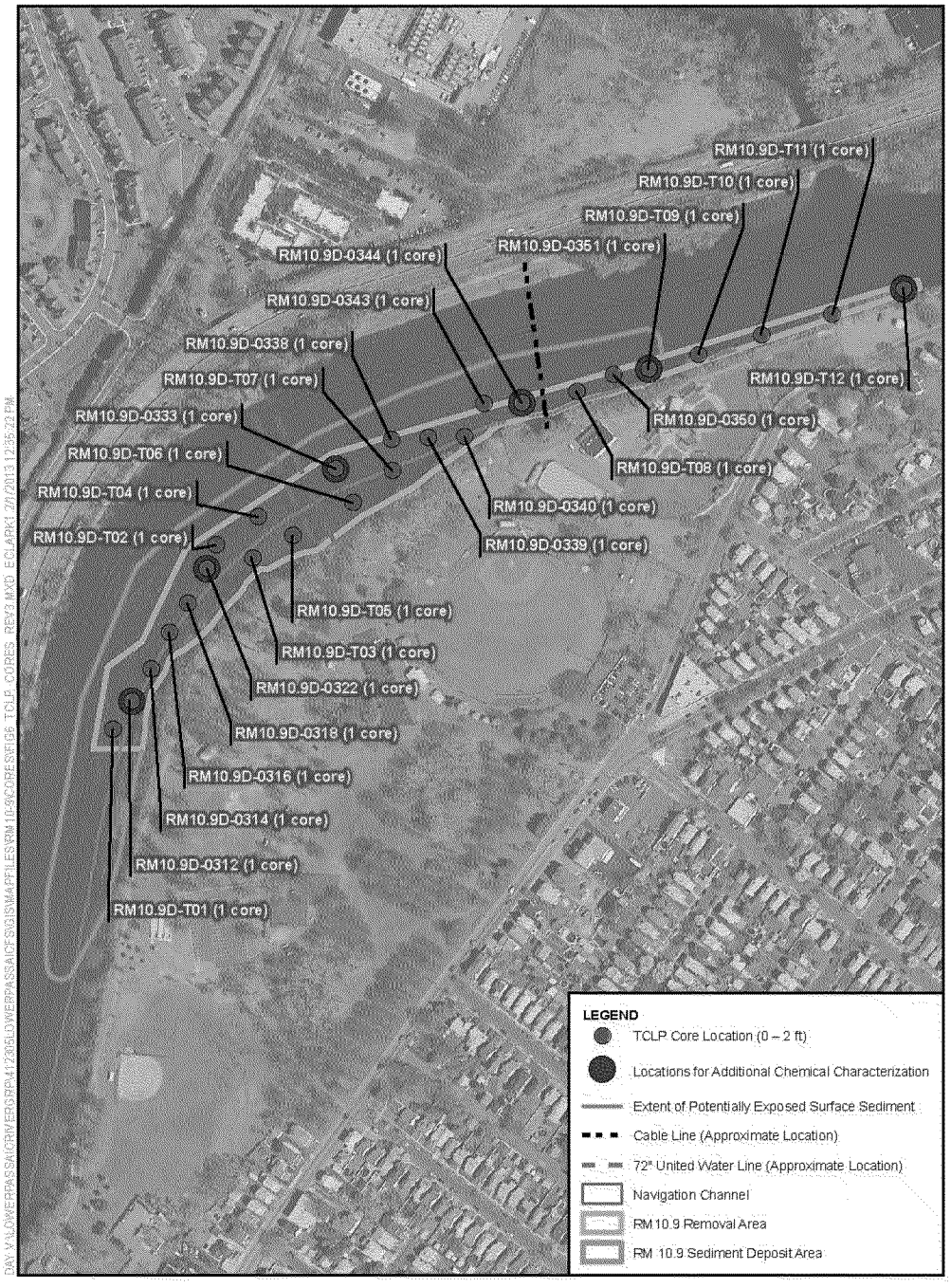


Table 8. Sediment Core Segments for Stabilization Treatability Study

Total Core Segments	26	Composite Allocation	
Location	No. Cores (0 - 2ft)	Sediment Composite	Vendor Distribution
RM10.9D-0314	4	Composite 1: 8 core segments ~8 gallons	Vendor 1 (~4 gallons)
RM10.9D-0318	4		Vendor 2 (~4 gallons)
RM10.9D-0333	3	Composite 2: 9 core segments ~10 gallons	Vendor 1 (~5 gallons)
RM10.9D-0338	3		
RM10.9D-0339	3		Vendor 2 (~5 gallons)
RM10.9D-0343	3	Composite 3: 9 core segments ~10 gallons	Vendor 1 (~5 gallons)
RM10.9D-0344	3		
RM10.9D-0351	3		Vendor 2 (~5 gallons)



Notes:
1. Orthophoto: NJGIS, 2007
2. The Extent of Potentially Exposed Surface Sediment was generated from the -2ft (NGVD29) elevation, which represents the Mean Low Water for this part of the river. The data source was the July 2011 Bathymetry Survey conducted as part of the RM 10.9 Characterization Program (CH2M HILL & AECOM, 2012).

FIGURE 6
TCLP Characterization Core Locations
Lower Passaic River Study Area, New Jersey

Table 9. Sediment Core Segments for TCLP and Chemical Characterization

Total Core Segments		25			
Location	No. Cores (depth interval)	Composite and prepare samples for designated laboratories	Location	No. Cores (depth interval)	Composite and prepare samples for designated laboratories
RM10.9D-0312*	1 (0 - 2 ft)	1	RM10.9D-T01	1 (0 - 2 ft)	1
RM10.9D-0314	1 (0 - 2 ft)	1	RM10.9D-T02	1 (0 - 2 ft)	1
RM10.9D-0316	1 (0 - 2 ft)	1	RM10.9D-T03	1 (0 - 2 ft)	1
RM10.9D-0318	1 (0 - 2 ft)	1	RM10.9D-T04	1 (0 - 2 ft)	1
RM10.9D-0322*	1 (0 - 2 ft)	1	RM10.9D-T05	1 (0 - 2 ft)	1
RM10.9D-0333*	1 (0 - 2 ft)	1	RM10.9D-T06	1 (0 - 2 ft)	1
RM10.9D-0338	1 (0 - 2 ft)	1	RM10.9D-T07	1 (0 - 2 ft)	1
RM10.9D-0339	1 (0 - 2 ft)	1	RM10.9D-T08	1 (0 - 2 ft)	1
RM10.9D-0340	1 (0 - 2 ft)	1	RM10.9D-T09	1 (0 - 2 ft)	1
RM10.9D-0343	1 (0 - 2 ft)	1	RM10.9D-T10	1 (0 - 2 ft)	1
RM10.9D-0344*	1 (0 - 2 ft)	1	RM10.9D-T11	1 (0 - 2 ft)	1
RM10.9D-0350	1 (0 - 2 ft)	1	RM10.9D-T12*	0 (0 - 2 ft)	1
RM10.9D-0351*	1 (0 - 2 ft)	1	*Core location will also be characterized for PCDDs/PCDFs, PCBs, and Mercury		

QAPP Worksheet #1 (UFP-QAPP Manual Section 2.1) Title and Approval Page

Document Title: Lower Passaic River Study Area, River Mile 10.9 Characterization Addendum D – Sediment Collection to Support Removal Action Design and Dredge Material Characterization

Lead Organization: Cooperating Parties Group and de maximis, inc.

Preparer's Name and Organizational Affiliation: Jennifer Wilkie, CH2M HILL

Preparer's Address and Telephone Number: 125 South Wacker Drive, Suite 3000, Chicago, IL 60606.

Ph: (312) 873-9795

Preparation Date (Day/Month/Year): Revision 1, Addendum D – Sediment Collection to Support Removal Action Design and Dredge Material Characterization, February 2013

Investigative Organization's Project Manager

Roger McCready/CH2M HILL / February 2013

Investigative Organization's Project Quality Assurance (QA) Manager

Andrea DePoy / CH2M HILL / February 2013

Lead Organization's Project Manager

Willard Potter / Robert Law / Stan Kaczmarek/ de maximis, inc. / February 2013

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Site Name/Project Name:	**Diamond Alkali Operable Unit (OU 2) – LPRRP RI/FS**
Site Location:	**Lower Passaic River Study Area (LPRSA), New Jersey**
Site Number/Code :	**CERCLA Document No. 02-2007-2009**
Operable Unit:	**OU 2**
Contractor Name:	**CH2M HILL**
Contractor Number:	**Not Applicable (N/A)**
Contract Title:	**N/A**
Work Assignment Number:	**N/A**

1. Identify guidance used to prepare QAPP:

   Uniform Federal Policy for Quality Assurance Project Plans. Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs. Part 1: UFP-QAPP Manual. Final Version 1. March 2005. Intergovernmental Data Quality Task Force (US Environmental Protection Agency, US Department of Defense, US Department of Energy). USEPA 505-B-04-900A.

2. Identify regulatory program: Comprehensive Environmental Response Compensation, and Liability Act (CERCLA)

3. Identify approval entity: USEPA Region 2

4. Indicate whether the QAPP is a generic or a project-specific QAPP. (circle one)

5. List dates of scoping sessions that were held: November 15, 2012; November 29, 2012; December 7, 2012 (RM 10.9 QAPP Addendum D)

6. List dates and titles of QAPP and FSP documents written for previous site work, if applicable:

Title
CLH 1995. *Work Plan, Vol. 1 of Passaic River Study Area Remedial Investigation Work Plans*. Chemical Land Holdings (now Tierra Solutions, Inc.), Newark, NJ. January 1995.
Tierra Solutions, Inc. 1999. *Passaic River Study Area Ecological Sampling Plan. Quality Assurance Project Plan*. March 1999.
MPI 2005. *Lower Passaic River Restoration Project. Quality Assurance Project Plan.* Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2006. *Lower Passaic River Restoration Project. Field Sampling Plan*. Volume 1. Prepared for US Environmental Protection Agency, US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2007. *QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation*. December 2007.
ENSR 2008. *Lower Passaic River Restoration Project RI/FS. Quality Assurance Project Plan. RI Low Resolution Coring/Sediment Sampling*. Revision 4. ENSR, Westford, MA. October 2008.

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Windward 2009a. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Fish and Decapod Crustacean Tissue Collection for Chemical Analysis and Fish Community Survey*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA. August 2009.
Windward 2009b. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. October 8, 2009. Windward Environmental LLC, Seattle, WA. October 2009.
AECOM 2010a. *Lower Passaic River Restoration Project: Periodic Bathymetric Surveys. Quality Assurance Project Plan*. Revision 2. AECOM, Westford, MA. May 2010.
AECOM 2010b. *Quality Assurance Project Plan/Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring. Lower Passaic River Restoration Project.* Revision 4. AECOM, Westford, MA. March 2010. Referred to herein as the AECOM 2010 Water Column Monitoring QAPP.
Tierra Solutions, Inc. 2010c. *Combined Sewer Overflow/Stormwater Outfall Investigation Quality Assurance Project Plan. Lower Passaic River Study Area*. Revision 0. July 2010.
AECOM 2011. *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan*. Revision 3. Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA. October 2011.
AECOM, 2011b. *River Mile 10.9 Hydrodynamic Field Investigation Quality Assurance Project Plan for the Lower Passaic River, Lower Passaic River Restoration Project*, October 2011, Revision 2.
AECOM 2012a. *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addendum A. Sediment Collection for Bench-Scale Testing of Sediment Treatment and Dewatering Technologies and for Additional Delineation*. Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA. May 2012.
AECOM 2012b. *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addendum B. Bench-Scale Testing of Sediment Treatment Technologies*. Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA.
AECOM 2012c. *Remedial Investigation Water Column Monitoring/High Volume Chemical Data Collection QAPP*, Rev. 0, May 2012.
CH2M HILL 2012. Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan Addendum C. Data Gap Sample Collection to Support Sediment Removal Activities. Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA. (in progress).

7. List organizational partners (stakeholders) and connection with lead organization:

   This work will be performed under the requirements of the Settlement Agreement and SOW for the Lower Passaic River Study Area portion of the Diamond Alkali Superfund Site with oversight by USEPA and its government partners (e.g., NJDEP). Conducting the work on behalf of the CPG are de maximis, inc. (acting as Project Coordinator for the CPG) and CH2M HILL and its subcontractors.

8. List data users: See item #7 above.

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table.
Provide an explanation for their exclusion below: N/A ____

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps	9 9 10 and Introduction Figure 1
2.6 Project Quality Objectives (PQOs) and Measurement Performance Criteria 2.6.1 Development of PQOs Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	14 15 16
Measurement/Data Acquisition		

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field QC Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17 Figure 1 18 19 20 Appendix A (Original QAPP) 21 22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Appendix B(Original QAPP) 23 24 25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation - Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow - Example Chain-of-Custody Form and Seal	26 Appendix A (Original QAPP) 27 27 Appendix A (Original QAPP)
3.4 QC Samples 3.4.1 Sampling QC Samples 3.4.2 Analytical QC Samples	- QC Samples Table	28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management Procedures	29 30
Assessment/Oversight		

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Planned Project Assessments Table - Assessment Findings and Corrective Action Responses Table	31 32
4.2 QA Management Reports	- QA Management Reports Table	33
4.3 Final Project Report	To be completed following data collection	Not Available (NA)
Data Review		
5.1 Overview 5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	34 35 36 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	To be completed following data evaluation	NA

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

The following persons will receive a copy of the approved Final QAPP, subsequent QAPP revisions, addenda, and amendments:

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
Roger McCready	RM 10.9 Project Manager	CH2M HILL	937.220.2961	Roger.McCready@ch2m.com	
Jennifer Wilkie	RM 10.9 Characterization QAPP Addendum D Task Manager	CH2M HILL	312.873.9795	Jennifer.Wilkie@ch2m.com	

*Uncontrolled electronic copies will be available on www.ourpassaic.org

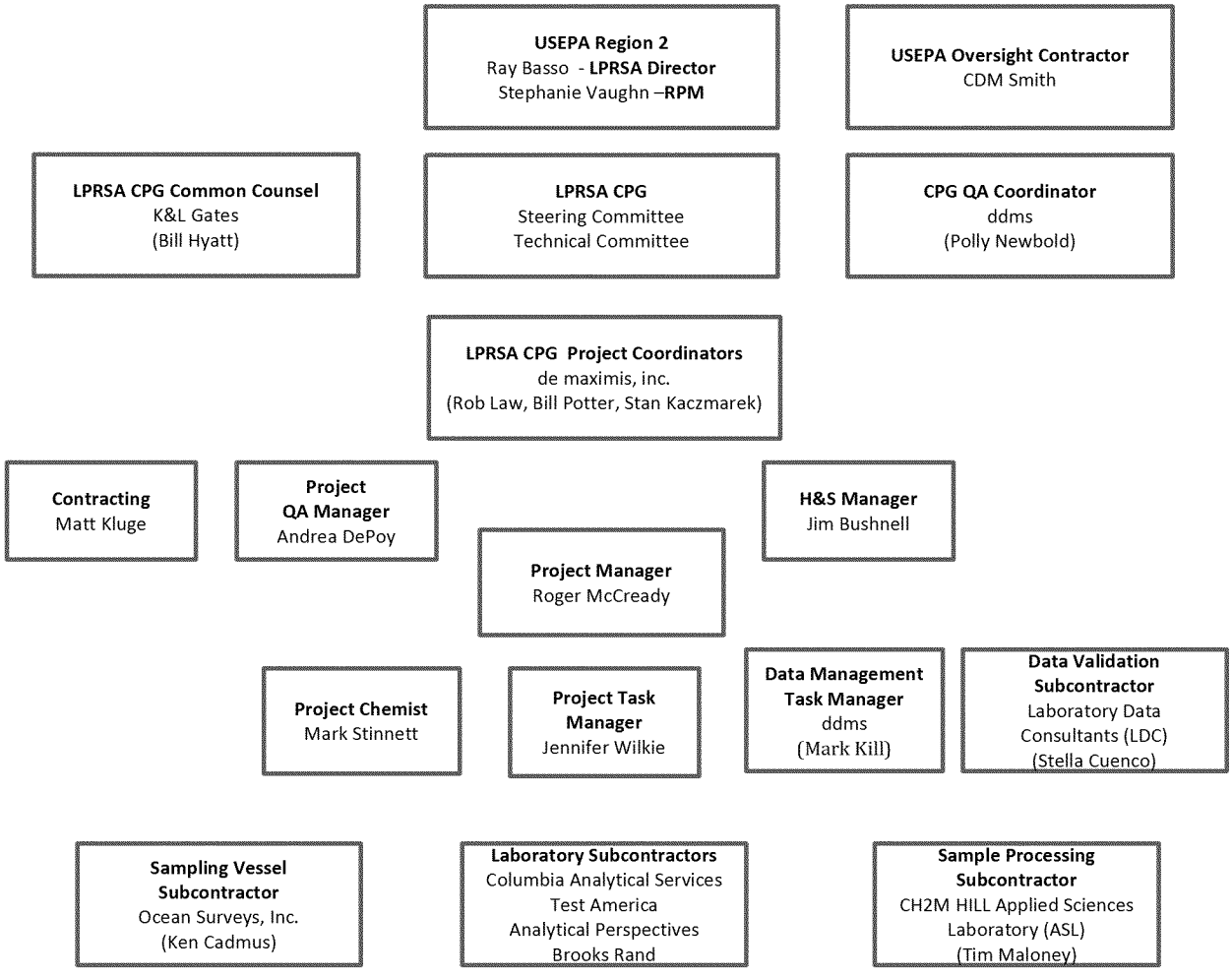
QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) Project Personnel Sign-Off Sheet

Organization: A completed sign-off sheet will be maintained in the files for each organization represented below.

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
Roger McCready	RM 10.9 Project Manager	CH2M HILL	937.220.2961	Roger.McCready@ch2m.com	
Jennifer Wilkie	RM 10.9 Characterization QAPP Addendum D Task Manager	CH2M HILL	312.873.9795	Jennifer.Wilkie@ch2m.com	
Tim Maloney	CH2M HILL ASL Task Manager	CH2M HILL ASL	541.768.3124	Tim.Maloney@ch2m.com	
[TBD]	Sampling Vessel Lead	Ocean Surveys, Inc (OSI)	[TBD]	[TBD]	

*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

QAPP Worksheet #5 (UFP-QAPP Manual Section 2.4.1) Project Organizational Chart



QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathway

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Field activities status and issues	CH2M HILL Field Team Lead	Mike Murphy	973.316.3536 Cell 551.486.3621	Communicate, as needed with CH2M HILL PM, subcontractors, and CH2M HILL project team directly, or via e-mail or phone. Minor work plan deviations and/or proposed revisions will be documented and communicated in writing, with a copy sent to USEPA.
Sampling progress/laboratory coordination	CH2M HILL Task Manager	Jennifer Wilkie	312.873.9795 Cell 224.659.9101	Communicate as needed with CH2M HILL Project Chemist via e-mail or phone.
Health and safety briefings and updates	CH2M HILL Field Team Lead	Mike Murphy	973.316.3536 Cell 551.486.3621	Communicate, as needed, with field personnel and vendors directly, or via e-mail or phone.
Significant health and safety concerns or incidents	Field Team Lead	Mike Murphy	973.316.3536 Cell 551.486.3621	Communicate immediately with CH2M HILL Regional EHS Manager, CH2M HILL PM.
Sampling vessel operations	Sampling Vessel Lead	[TBD], OSI	[TBD]	Communicate daily, or as needed, with CH2M HILL Task Manager directly. The sampling vessel lead has the ultimate authority for stopping work while working on water. The sampling vessel lead, in consultation with the Field Team Lead (FTL), will follow guidelines documented in the site-specific Health and Safety Plan (HASP). In addition, standard safe boating practices related to weather conditions and vessel operations will apply, even if not specifically addressed in the HASP.
Sample Processing	CH2M HILL ASL Task Manager	Tim Maloney	541.768.3124	Communicate daily, or as needed, with CH2M HILL Task Manager directly.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathway

Analytical laboratory issues, including coordination with field, bench-scale treatability testing, schedule, and technical issues	CH2M HILL Project Chemist	Mark Stinnett	352.384.7180	Communicate with Laboratory PM as needed via phone or e-mail.
Nonconformances (field and/or laboratory)	CH2M HILL Data Validation Coordinator	Mark Stinnett	352.384.7180	Communicate with CH2M HILL PM, CH2M HILL Task Manager, and Laboratory PM as needed via phone or e-mail.
Issues potentially affecting DQOs	CH2M HILL Field Team Lead	Mike Murphy	973.316.3536 Cell 551.486.3621	Communicate with CH2M HILL QA Manager and CH2M HILL PM as needed, via e-mail or phone. Notification of the CPG QA Coordinator as appropriate.
	Sampling Vessel Lead	[TBD], OSI	TBD	
	CH2M HILL ASL Task Manager	Tim Maloney	541.768.3124	
	ddms Data Management Task Manager	Mark Kill	651.842.4232	
	CH2M HILL Project Chemist	Mark Stinnett	352.384.7180	
	CH2M HILL Task manager	Jennifer Wilkie	312.873.9795 Cell 224.659.9101	Communicate with CH2M HILL QA Manager and CH2M HILL PM as needed, via e-mail or phone. Notification of the CPG QA Coordinator as appropriate. Significant work plan modifications will be reported to USEPA in writing prior to implementation.
Sediment sample collection task implementation, including sampling, analysis, and reporting	CH2M HILL Field Team Lead	Mike Murphy	973.316.3536 Cell 551.486.3621	Communicate with CH2M HILL Task Manager as needed, via email or phone.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathway

Project status and issues (internal)	CH2M HILL Project Manager	Roger McCready	937.220.2961	Communicate with CPG Project Coordinator, as needed, via email or phone, and submit monthly progress reports.
Project status and issues (external)	CPG Coordinating Counsel	William Hyatt / Dawn Monsen (K&L Gates)	973.848.4045 or 4148	In the event the CPG Project Coordinator is unavailable for communication with USEPA, the CH2M HILL PM will notify the Coordinating Counsel prior to contacting USEPA.
	CPG Project Coordinator	Willard Potter/ Robert Law/ Stan Kaczmarek (de maximis, inc.)	908.735.9315	Communicate with USEPA RPM as needed via e-mail or phone.
Quality status and issues	CPG QA Coordinator	Polly Newbold (ddms)	908.479.1975	Communicate with CPG Project Coordinator as needed via email or telephone
Data management	ddms Data Management Task Manager	Mark Kill	651.842.4232	Communicate with the Data Management Task Manager via email; transmit final field locations and sample collection information daily.
	Laboratory PMs	See Worksheet #30	See Worksheet #30	Maintain comprehensive project technical database, communicate with CH2M HILL Task Manager to receive data; communicate with Laboratory PM(s) to receive analytical result data, communicate with CH2M HILL Task Manager to provide data for review; and provide data deliverables to USEPA.
Stop Work (technical non-compliance)	CH2M HILL Field team, Subcontractors, Project QA Manager, Project Chemists, and Data Management Task Manager			Any personnel believing that a work stoppage is necessary shall first verbally notify the CH2M HILL Task Manager or the CH2M HILL PM, who will in turn verbally notify de maximis, inc. and/or CH2M HILL QA Manager, if necessary. Given the potential significance of such communications, this will occur as quickly as possible.

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Robert Law	CPG Project Coordinator (Lead)	de maximis, Inc.	Overall responsibility for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project quality assurance/quality control (QA/QC), and Health and Safety (H&S) including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	PhD, Geology, 26 years experience
Willard Potter	CPG Project Coordinator (Alternate)	de maximis, Inc.	Serves as back up for the Lead CPG Project Coordinator. Responsible for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project QA/QC, and H&S including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	BS, Chemical Engineering, 36 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Stan Kaczmarek	CPG Project Coordinator (Alternate)	de maximis, inc.	Serves as back up for the Lead CPG Project Coordinator. Responsible for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project QA/QC, and Health and Safety including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	MS, Environmental Engineering, BS, Biological Sciences, 34 years experience
Roger McCready	Project Manager	CH2M HILL	Overall responsibility for technical oversight of Removal Action tasks in accordance with SOW requirements including technical, financial, and scheduling. Primary point of contact for CH2M HILL with CPG Project Coordinator.	MS and BS, Geology, 24 years experience
Jennifer Wilkie	Task Manager	CH2M HILL	Responsible for the execution and completion of the scope of work identified in this addendum under the RM 10.9 Characterization program, including procurement of subcontractors, review of task deliverables, and serving as the focus for coordination of all field and laboratory tasks. The CH2M HILL Task Manager will keep the CH2M HILL PM apprised of the status of the task; as well communicate any issues with the schedule, budget, or achievement of the task objectives.	PhD, Civil and Environmental Engineering, MS and BS, Chemical Engineering, BS Biomedical Engineering, over 15 years experience
Andrea DePoy	Project QA Manager	CH2M HILL	Responsible for reviewing and approving QA procedures, ensuring that planned QA assessments (e.g., data validation) are conducted according to this QAPP Addendum and reporting on the adequacy of the QA Program to the CH2M HILL PM.	B.S.E., Geo-Environmental Engineering, 14 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Jim Bushnell	Regional EHS Manager	CH2M HILL	Responsible for ensuring that the objectives of CH2M HILL's Health and Safety Program are met and for monitoring task activities for conformance to the HASP.	BS, Chemical Engineering, 30 years experience
Mark Stinnett	Project Chemist and Data Validation Coordinator	CH2M HILL	Responsible for laboratory procurement and monitoring of progress and will be the primary point of contact with the laboratories. The Project Chemist will also be responsible for communicating any issues that could affect achievement of the DQOs to the CH2M HILL Task Manager and the CH2M HILL Project QA Manager. Responsible for managing the validation task, including ensuring that validation is conducted and documented according to the requirements of this QAPP, and interacting with the laboratories to resolve any issues.	BS, Chemistry, 28 years experience
Tim Maloney	CH2M HILL ASL Task Manager	CH2M HILL ASL	Acts as the primary point of contact at CH2M HILL ASL facility for the CH2M HILL Project Chemist and Task Manager to communicate and resolve sample processing issues.	MS, Chemistry, over 30 years experience
Mike Murphy	CH2M HILL Field Team Lead	CH2M HILL	Responsible for implementing field sampling activities in accordance with the approved plans QAPP, HASP and pertinent SOPs. Primary responsibilities will include directing activities on site, monitoring subcontractor performance in the field, reviewing field records, and communicating daily with the CH2M HILL PM regarding status, quality issues, or delays.	MS, Environmental Systems Engineering, BA, Geography, 7 years experience
Mark Kill	Data Management Task Manager	ddms, inc.	Responsible for data management for project, Including overall responsibility for database quality and structure, including graphical representation of data.	BA, Geography, 13 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

John Reynolds	Laboratory PM	Test America	Acts as the primary point of contact at Test America facilities for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all Test America network laboratories.	BS, Biology, 16 years experience
Lynda Huckestein	Laboratory PM	Columbia Analytical Services (CAS)	Acts as the primary point of contact at CAS facilities for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all CAS network laboratories.	BS, Microbiology, 22 years experience
Misty Kennard-Mayer	Laboratory PM	Brooks Rand, LLC	Acts as the primary point of contact at Brooks Rand, LLC for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BS, Environmental Science, 7 years experience
Todd Vilen	Laboratory PM	Analytical Perspectives	Acts as the primary point of contact at Analytical Perspectives for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BA, Chemistry, BS, Aquatic Biology, 24 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI River Mile 10.9 Characterization Addendum D - Sediment Collection to Support Removal Action Design and Dredge Material Characterization **Projected Date(s) of Sampling: February 2013** **Project Manager: Roger McCready**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA; RM 10.9**

Date of Session: 15 November 2012

Scoping Session Purpose: RM 10.9 Addendum D scoping session: Discussion among CH2M HILL team to identify sample collection needs to support removal action design and meet landfill disposal requirements.

Name	Affiliation	Phone #	E-mail Address	Project Role
Roger McCready	CH2M HILL	937.220.2961	Roger.McCready@ch2m.com	CPG Technical Consultant
Mike Jury	CH2M HILL	414.847.0363	Mike.Jury@ch2m.com	CPG Technical Consultant
Jennifer Wilkie	CH2M HILL	312.873.9795	Jennifer.Wilkie@ch2m.com	CPG Technical Consultant
James Brinkman	CH2M HILL	617.523.2002	James.Brinkman@ch2m.com	CPG Technical Consultant
Devamita Chattopadhyay	CH2M HILL	937.220.2959	Devamita.Chattopadhyay@ch2m.com	CPG Technical Consultant

Comments/Decisions: Discussed data needs for the cap design activities. Decision to analyze pore water for the following constituents was made: PCDDs/PCDFs, PCBs, PAHs, mercury, TOC, and DOC. Team also discussed landfill requirements and collection of additional RM 10.9 Removal Area cores for TCLP characterization.

Project Name: RI River Mile 10.9 Characterization Addendum D - Sediment Collection to Support Removal Action Design and Dredge Material Characterization **Projected Date(s) of Sampling: February 2013** **Project Manager: Roger McCready**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA; RM 10.9**

Date of Session: 29 November 2012

Scoping Session Purpose: LPRSA CPG – NJDEP Meeting Summary, discussion regarding material to be used in stabilization treatability studies

Name	Affiliation	Phone #	E-mail Address	Project Role
Jay Nickerson	NJDEP	609-633-1448	Jay.nickerson@dep.state.nj.us	LPR Case Manager (SRP/BCM)
Negib Harfourche	NJDEP	609-292-2137	Negib.harourche@dep.state.nj.us	Env. Engin. 3 (principal) (BAP/ER/Air)
Janine MacGregor	NJDEP	609-633-0748	Janine.macgregor@dep.state.nj.us	Proj. Coordinator (SRP)
David Risilia	NJDEP	609-292-9342	Dave.risilia@dep.state.nj.us	Proj. Manager (SRP/ODST)
Suzanne Dietrick	NJDEP	609-292-8838	Suzanne.dietrick@dep.state.nj.us	Chief (SRP/ODST)
Joel A. Pecchioli	NJDEP	609-633-2200	Joel.percchioli@dep.state.nj.us	Research Scientist I (SRP/ODST)

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Comments/Decisions: NJDEP stated that if the CPG is going to do additional sampling at the RM 10.9 Removal Area, new sediment samples need to be collected and bench-scale stabilization testing of the material needs to be performed. NJDEP indicated that in order for its Office of Dredging and Sediment Technology (ODST) to issue an Acceptable Use Determination (AUD) to the facility to process the material, it is necessary to do the bench-scale testing of the proposed end product. If stored sediment is beyond holding times, it cannot be used to do the bench-scale testing. NJDEP also stated that based on the recent storm, the data generated from the stored sediment may not be representative of what will be dredged during the RM 10.9 Removal Action.

Project Name: RI River Mile 10.9 Characterization Addendum D - Sediment Collection to Support Removal Action Design and Dredge Material Characterization **Projected Date(s) of Sampling: February 2013** **Project Manager: Roger McCready**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA; RM 10.9**
Date of Session: 07 December 2012 **Scoping Session Purpose**: Discussion among CH2M HILL staff and de maximis, inc. to finalize the scope of the RM 10.9 Characterization Addendum D activities.	

Name	Affiliation	Phone #	E-mail Address	Project Role
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Comments/Decisions: A summary of the proposed scope of QAPP Addendum D activities was presented and evaluated by the team. It was determined that 25 TCLP cores were needed in addition to the two composite TCLP samples from QAPP Addendum B (Sediment Washing Bench-Scale Studies) could be

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used to reach the total of 27 TCLP composites required by the landfills. The sediment cores for pore water characterization were also discussed and a decision was made to collect the pore water extracted from the various core segments into a single composite sample. The composite pore water sample will then be decanted into the various laboratory provided bottles for analysis. A single pore water sample representing the area under the cap will be analyzed. Unused pore water from the primary analyses will be used to run duplicates, when available.

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Project Name: RI River Mile 10.9 Characterization Addendum D - Sediment Collection to Support Removal Action Design and Dredge Material Characterization **Projected Date(s) of Sampling: February 2013** **Project Manager: Roger McCready**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA; RM 10.9**
Date of Session: 30 January 2013 **Scoping Session Purpose**: Discussion with USEPA to review response to comments on Rev. 0 of RM 10.9 Characterization Addendum D and to finalize the scope of the sampling program for incorporation into QAPP D Rev 1.	

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Comments/Decisions: The CPG's responses to comments received to date on Rev. 0 of the RM 10.9 Characterization Addendum D were reviewed and accepted by USEPA. This resulted in an expansion of the QAPP D sampling program to include 6 additional sediment samples for characterization of selected analytes (PCDDs/PCDFs, PCB congeners and homologs, and mercury). These additional samples will be collected from 6 of the existing TCLP core locations to provide additional characterization data of the RM 10.9 Removal Area.

QAPP Worksheet #10 (UFP-QAPP Manual Section 2.5.2) Problem Definition

The problem to be addressed by the RM 10.9 QAPP Addendum D:

The RM 10.9 Removal Action includes dredging of the top 2 ft of sediment followed by capping. Determination of the thickness of the active layer of the sediment cap is dependent on a number of factors, including the concentrations of site-specific COPCs in pore water. Currently there is a data need regarding concentrations of COPCs in the pore water within the RM 10.9 Removal Area. Sample collection and analyses are proposed to obtain concentrations of COPCs in the pore water within the 2-4 ft interval, representative of sediment remaining after dredging (under the cap). Additional sediment cores will also be collected to support mercury treatability studies, if needed.

Disposal of dredged material to a landfill will require stabilization and TCLP characterization of the stabilized dredge material. With the assumption that approximately 18,000 cy of sediment will be disposed, 25 core segments will be collected and individually composited within the dredge area (0 – 2 ft interval) for the following analyses: TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, TCLP mercury, and TCLP metals. Six of the TCLP characterizations cores will also be submitted to the laboratories for analysis of PCDDs/PCDFs, PCBs, and mercury for additional characterization of the sediment in the RM 10.9 Removal Area. Additional sediment cores within the dredge area (0 – 2 ft interval) will be collected for stabilization treatability testing.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

	RM 10.9 QAPP Addendum D Data Quality Objective (DQO): Collect representative sediment cores for a stabilization treatability study and a potential bench-scale mercury treatability testing and for conducting the following analyses: determination of COPCs in pore water, and conducting TCLP analysis of sediment
DQO Step	**Description**
STEP 1 **State the problem**	The RM 10.9 Removal Action will dredge approximately 18,000 cy of sediment and install a cap over the underlying sediments to isolate remaining COPCs in sediment. Site-specific data are needed to finalize the design of the cap's active layer thickness required to limit the migration of site-specific COPCs. The thickness of the active layer is determined using a numerical model, CAPSIM, which requires information on the COPC concentrations in pore water. Additionally, in order to dispose of the dredged material to an offsite upland landfill, TCLP characterization of the dredge material is needed. In addition, 6 of the TCLP cores will be sampled and analyzed for PCDD/PCDFs. PCBS and mercury for additional characterization of the RM 10.9 Removal Area sediment. The sediment will also undergo stabilization treatability tests to determine the percentage of stabilizing agent needed for shipment to an offsite landfill. Sediment cores will also be collected and stored for a potential mercury treatability study.
STEP 2 **Identify the goals of the study**	**Principal Study Questions** 1. What is the appropriate active layer cap thickness to limit migration of site-specific COPCs present in the sediment? 2. Will the dredged sediment meet TCLP requirements? **Program Goals** The goal of this sampling program is to collect sediment cores of representative quality and of sufficient volume to allow extraction of pore water for the characterization of site-specific COPCs in the 2 to 4-ft interval below the sediment surface. Pore water extracted from the sediment cores will be analyzed for the following parameters using the same methods, and by the same laboratories, as specified in the RM 10.9 QAPP (refer to RM 10.9 QAPP Worksheets #19, 23, and 30): • PCDDs/PCDFs (2 composite samples) • PCBs (homologs and congeners) (2 composite samples)

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PAHs and alkyl PAHs (2 composite samples)
- Total and dissolved mercury and methyl mercury (2 composite samples)
- Total and dissolved organic carbon (2 composite samples)

Sediment cores will be collected from within the 0 to 2-ft interval, to perform stabilization treatability testing and to characterize the dredge material for the following parameters using the same methods, and by the same laboratories, as for the RM10.9 IDW disposal characterization (as described in Appendix F of the Draft River Mile 10.9 Characterization Program Summary, Lower Passaic River Study Area, CH2M HILL and AECOM, March 2012):

- PCDDs/PCDFs (6 Locations)
- PCBs (6 Locations)
- Mercury, low-level (6 Locations)
- TCLP SVOCs (25 Locations)
- TCLP organochlorine pesticides (25 Locations)
- TCLP chlorinated herbicides (25 Locations)
- TCLP mercury (25 Locations)
- TCLP metals (25 Locations)

Another goal of this sampling program is to collect sediments for a potential mercury treatability study. For this potential work, sediment cores will be collected from areas within the RM 10.9 Removal Area with relatively high concentrations of mercury, in comparison to the other sediments in the RM 10.9 Removal Area, in the 2 to 4-ft interval below the sediment surface.

Alternative Actions

The following alternative actions could result from resolution of the principal study questions:

1. Evaluate alternative methods for pretreating RM 10.9 Removal Area sediment for disposal purposes.

Decision Statements on Collection of Representative Sediment Samples

1. If by comparison to the RM 10.9 analytical data the sediments collected as part of this RM 10.9 QAPP Addendum are representative of the sediments in the RM 10.9 Removal Area (with relatively high concentrations, in comparison to the other sediments in the RM 10.9 sediment deposit, of PCDDs/PCDFs, PCBs, mercury, and PAHs), then no further action is required.
2. If by comparison to the RM 10.9 analytical data the sediments collected as part of this RM 10.9 QAPP

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	Addendum are not representative of the sediments in the RM 10.9 Removal Area (with relatively high concentrations, in comparison to the other sediments in the RM 10.9 sediment deposit, of PCDDs/PCDFs, PCBs, mercury, and PAHs),then the estimated pore water concentrations calculated using the equilibrium partitioning (EqP) method will continue to be used in the final cap design numerical modeling runs.

STEP 3
Identify the information inputs
	Information required to answer the decision statement will include the existing field data and data to be obtained from the planned sampling events (See Step 5 of RM 10.9 Addendum DQO 1), as summarized below.
	New Data Needed
	• Representative sediment cores from the region to be capped within the RM 10.9 Removal Area for analysis of pore water concentrations of select COPCs
	  ◦ Sediment cores will be sent intact from the field to a designated laboratory for extraction of pore water via centrifugation and subsequent chemical analysis
	  ◦ A subset of intact sediment cores will be stored frozen at a designated laboratory for potential mercury treatability studies
	• Representative sediment cores from the RM 10.9 Removal Area for Toxicity Characteristic Leaching Procedure (TCLP) analyses to support future disposal of the dredge material
	• Representative sediment cores from the RM 10.9 Removal Area for stabilization treatability studies to support future disposal of the dredge material
	Existing Field Data
	1. CH2MHILL and AECOM, March 2012. Draft River Mile 10.9 Characterization Program Summary, Lower Passaic River Study Area.
	Existing Reports
	1. AECOM, 2011. Draft Low Resolution Coring Characterization Summary. Lower Passaic River Study Area RI/FS.
	2. CH2M HILL and AECOM, March 2012. Draft River Mile 10.9 Characterization Program Summary, Lower Passaic River Study Area.

STEP 4 **Define the boundaries of the study**	**Geographic Area** The RM 10.9 Removal Area is located between RM 10.8 to RM 11.1 and includes the mudflat and point bar in the east half of the river channel (Figure 1). Sediment samples will be collected within the RM 10.9 Removal Area. **Timeframe**

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	Samples will be collected over an estimated two-week period. **Sample Type** Sediment sampling will include core samples to a depth of four feet below the sediment surface (note the sampler will be advanced one additional foot to provide a plug to keep the sample in the sampler).
STEP 5 **Develop the analytical approach**	**Approach for Collecting Samples** Vibracores will be used to collect the sediment samples (per SOP LPR-S-04). After collection, intact sediment cores will be cut, capped and sealed prior to processing/shipping. Cores and sediment samples will be placed on ice for transport to the designated laboratories. Core compositing for TCLP, sediment characterization, and stabilization treatability studies will be performed at the field facility. Piston coring or push coring may be used, if more appropriate, based on sediment encountered (per SOP LPR-S-02). **Anticipated Analytical Methods for Pore Water** The following is the list of analytes and the corresponding analytical methods for the pore water: • PCDDs/PCDFs using EPA Method 1613B • PCBs (homologs and congeners) using EPA Method 1668A • PAHs and Alkyl PAHs using a laboratory-specific SOP based on California EPA Air Resources Board Method 429 and NOAA ORCA 130 Method • Mercury (low-level) using EPA Method 1631 • Methyl mercury (low level) using EPA Method 1630 • TOC using SW846-9060 • DOC using SW846-9060 **Anticipated Analytical Methods for Sediment Samples** The following lists the analytical methods for the sediment sampling: • PCDDs/PCDFs using EPA Method 1613B • PCBs (homologs and congeners) using EPA Method 1668A • Mercury, low-level using EPA Method 1631 • TCLP SVOCs using EPA Methods 1311/8270C • TCLP pesticides using EPA Methods 1311/8081

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	TCLP herbicides using EPA Methods 1311/8151A • TCLP mercury using EPA method 1311/7470/7471 • TCLP metals using EPA method 1311/6010 **Project Quantification Limits** The reporting limits for sediment are included in RM 10.9 QAPP Worksheet #15. The reporting limits for pore water samples are included in this QAPP Addendum as Worksheet #15. **Quality Assurance/Quality Control Program (QA/QC)** QA/QC samples will be analyzed with the sediment samples appropriate for each analytical test, such as laboratory duplicates, laboratory control and matrix control spikes (optional). RM 10.9 QAPP Worksheets #12 and #28 provide performance criteria of these precision and accuracy measurements. Field duplicates will be prepared for analysis if sufficient pore water volume is obtained. Equipment rinsate blanks will not be collected or analyzed. Data verification and validation protocols are detailed in RM 10.9 QAPP Worksheets #34, 35, 36, and 37. **Anticipated Data Evaluations** Analytical data (PCDDs/PCDFs, PCBs, and mercury) will provide additional characterization of sediment from the RM 10.9 Removal Area. .
STEP 6 **Specify performance or acceptance criteria**	Uncertainty is always present in the measurement and interpretation of environmental data. In this case, the focus is on collecting and interpreting data to understand the physical and chemical characteristics of the sediment and pore water in the RM 10.9 sediment deposit. In the absence of defined decision tolerance limits, the sampling design should still strive to identify possible sources of error and minimize them, to the extent practical. Both random and systematic errors can be introduced during the physical collection of the sample, sample handling, sample analysis, and data handling. Errors introduced through these steps will be controlled by preparing and following SOPs and establishing appropriate controls for data quality. These controls apply to field procedures (e.g., adherence to SOPs and field equipment calibration), laboratory analytical errors (e.g., calibration standard, internal standard, surrogate recoveries, and laboratory control sample), and data validation. The RM 10.9 QAPP worksheets provide further detail on error control procedures, both in the field and in the laboratory. Appendix B of the RM 10.9 QAPP (Field SOPs), Appendix C of the RM 10.9 QAPP (Laboratory SOPs), attached to this addendum (SOP LPR-FI-04) provide supporting details. Sampling design error is the result of the inherent variability of the sampled population over space and time, the

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	sample collection design, and the number of samples available upon which to base the decision. Because it is impossible to sample every inch of the study area, there is always a possibility that some feature of the natural variability is missed. Sampling design error can increase the chance for misrepresenting the natural variability by random error (imprecision) or systematic error (bias) in sampling. Because the number of samples controls how well the sampled population (i.e., RM 10.9 Removal Area) is characterized, use of the DQO process requires that the variability of data be understood to evaluate the tradeoff between uncertainty (confidence limit) and sampling intensity. The RM 10.9 data set has a characteristic natural variability that will be adequately represented if all other sources of variability are minimized. By reducing the errors associated with sample collection, handling, analysis, and reporting with the strict adherence and use of standardized and documented procedures, as well as the noting of deviations from these procedures, the induced variability of the data set is minimized and the data set is a better representation of the RM 10.9 Removal Area.
STEP 7 **Develop the detailed plan for obtaining data**	**RM 10.9 Sediment Sampling** The sediment sampling locations are shown in Figure 1 and comprise 25 separate locations within the RM 10.9 Removal Area. A total of 72 sediment cores (4" diameter) will be collected and appropriately segmented to obtain the required number of cores for each of the sampling objectives. Details of how many sediment cores will be collected from each location and how each core will be handled are discussed below. • Pore Water Characterization: The proposed number of cores will provide sufficient sediment volume to prepare two composite pore water samples. If excess pore water is present after the preparation of the primary composite samples, it will be used to generate "field duplicate" samples. In addition, the laboratories will be instructed to prepare "laboratory duplicate" samples with any pore water remaining after the analysis of the primary (and field duplicate, if generated) samples. *Organic COCPs* - A total of 44 sediment cores (2 – 4 ft depth interval) will be collected from 12 separate sampling locations within the proposed extent of the cap to capture the highest concentrations of dibenzodioxins/polychlorinated dibenzofurans (PCDDs/PCDFs), and polychlorinated biphenyls (PCBs). The 44 sediment cores will be divided into two separate groups to produce a total of two pore water composite samples (one composite sample per each group of 22 sediment cores), as shown on Figure 2 and Table 5. *Mercury* - A total of 6 sediment cores (2 – 4 ft depth interval) will be collected from 3 separate sampling locations within the proposed extent of the cap to capture the highest concentrations of mercury. The

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	6 sediment cores will be divided into two separate groups to produce a total of two pore water composite samples (one composite sample per each group of 3 sediment cores per composite sample), as shown on Figure 3 and Table 6. • Mercury Treatability Studies: Ten (10) sediment cores (2 – 4 ft depth interval) from the 10 highest mercury locations will be collected and stored frozen for potential mercury treatability studies, as shown on Figure 4 and Table 7. Each of the sediment cores collected above will be 4 feet (ft) long, however only the bottom 2-ft interval (2 - 4 ft depth interval) will be used for the pore water characterization and potential mercury treatability studies. The top 2-ft interval (0 – 2 ft) from many of these sediment cores will be used for either TCLP characterization or stabilization treatability tests as discussed in the next two bullets. • Stabilization Treatability Studies: A total of 26 sediment cores (0 – 2 ft depth interval) will be collected for use in the stabilization treatability studies. The core locations are shown on Figure 5 and Table 8. • TCLP Characterization: A total of 25 sediment cores (0 – 2 ft depth interval) will be individually composited over their entire core length and characterized for TCLP. The TCLP characterization core locations are shown on Figure 6 and Table 9. • Sediment Chemical Characterization: A total of 6 of the TCLP sediment cores (0 – 2 ft depth interval) will also be characterized for COPCs in sediment as indicated in Worksheet #11. These 6 locations have been selected to obtain spatial coverage of the Removal Area to provide additional characterization of the RM 10.9 Removal Area. The additional characterization core locations are shown on Figure 6 and Table 9.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PCDD/PCDFs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	A-1	Accuracy/Bias-Contamination	No target compound >QL	MB/Instrument Blank	A
	A-1	Accuracy/Bias	%D for RRF vs ICAL ≤ 20% except labeled analogs ≤ 30%	Batch control spike (BCS_3)[d]	A
	A-1	Accuracy/Bias	Compound-specific %Rs, see SOP	Labeled Compounds	A
	A-1	Accuracy/Bias	Supplier Certified Limits	QCCS Sample Analysis	A
	A-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	A-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] The BCS_3 is a special QC sample prepared with each 20 sample batch that combines all the spike solutions used on field samples with target analytes. It is analyzed at the beginning and end of each analytical sequence containing the associated samples.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PCBs – Congeners and Homologs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-6, T-5	Accuracy/Bias- Contamination	No target compound > QL	MB/Instrument Blank	A
	T-6, T-5	Accuracy/Bias	50-150%R Toxics/Level of Chlorination (LOC) congeners 40-160%R all other congeners	OPR sample (equivalent to LCS)	A
	T-6, T-5	Accuracy/Bias	30-140%R	Labeled compounds	A
	T-6, T-5	Accuracy/Bias	Supplier Certified Limits	QCCS Sample Analysis	A
	T-6, T-5	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-6, T-5	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PAHs and Alkyl PAHs (Low Resolution Mass Spectrometry [LRMS] – SIM)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-4, T-3	Accuracy/Bias-Contamination	No target compound >QL	MB/Instrument Blank	A
	T-4, T-3	Accuracy/Bias	60-140%R	LCS	A
	T-4, T-3	Accuracy/Bias	60-140%R in MB and LCS 30-120%R in field samples	Labeled compounds	A
	T-4, T-3	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	T-4, T-3	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-4, T-3	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Mercury (Low Level, total and dissolved)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	B-1	Accuracy/Bias-Contamination	Average MB <2x Method Detection Limit (MDL) and standard deviation <0.67x MDL or <0.1x the concentration of project samples	MB	A
	B-1	Accuracy/Bias	80 -120%R	LCS	A
	B-1	Accuracy/Bias	71 -125%R	MS	S & A
	B-1	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	B-1	Precision	RPD ≤24%	MSD	S & A
	B-1	Precision	RPD ≤24%	Laboratory Duplicate	A
	B-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	B-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Methyl Mercury (total and dissolved)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	B-2	Accuracy/Bias-Contamination	Average MB <0.045 nanograms per liter (ng/L) and standard deviation ≤0.015 ng/L or <0.1x the concentration of project samples	MB	A
	B-2	Accuracy/Bias	75-125%R	MS	S & A
	B-2	Precision	RPD ≤30% [d]	MSD	S & A
	B-2	Precision	RPD ≤30% (or ± QL if results are ≤5x the QL)	Laboratory Duplicate	A
	B-2	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	B-2	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

[d] Project specific matrix spike recovery limits for accuracy and precision. Laboratory is to refer to specific Scope of Work for guidance concerning this target analyte.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry –TOC and DOC				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-13, C-16	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-13, C-16	Accuracy/Bias	90-109%R	LCS	A
	C-13, C-16	Precision	RPD≤ 20%	LCS Duplicate (LCSD)	A
	C-13, C-16	Accuracy/Bias	≤110% of the unspiked sample	Inorganic Carbon Spike	A
	C-13, C-16	Accuracy/Bias	80-120%R	MS	A
	C-13, C-16	Precision	RPD≤ 20%	MSD	A
	C-13, C-16	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-13, C-16	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #13 UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Work Performed by CPG on the Passaic River				
Analytical data from the RM 10.9 Characterization Program	River Mile 10.9 Characterization Program Summary, Lower Passaic River Study Area, April 2012. Draft report submitted to USEPA	CPG. Sediment chemistry collected from RM 10.9 Study Area.	Data will used to develop input parameters for cap design. Additionally, data collected will aid in the disposal of the dredged material.	Samples collected during the RM10.9 Characterization Program did not include pore water. In addition, spatial coverage of the Removal Area with respect to TCLP characterization was not adequate to meet landfill requirements.

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

Sampling Tasks: The sampling program includes the collection of sediment cores to provide a sufficient volume of sediment for pore water characterization, potential mercury treatability studies, and stabilization treatability testing, additional chemical characterization and TCLP characterization of dredge material for future disposal at an offsite upland landfill. Sampling will be conducted using a boat-based vibracore. The sediment sampling locations are shown in Figure 1 and a summary of the sediment cores is provided in Table 3.

Sediment Processing:

After collection, intact sediment cores will be cut, capped and sealed prior to processing/shipping. A total of 50 sediment core segments (2 – 4 ft interval) will be processed for pore water characterization, 10 sediment core segments (2 – 4 ft interval) will be stored for potential mercury treatability studies, 26 sediment core segments (0 – 2 ft interval) will used in the stabilization treatability studies, 25 sediment core segments (0 – 2 ft interval) will be individually composited in the field and shipped to the designated commercial laboratory for TCLP characterization, and sediment samples from 6 of the 25 TCLP sediment cores will also be submitted for characterization of selected analytes (i.e., PCDD/PCDFs, PCBs, and mercury). CH2M HILL's Applied Science Laboratory (ASL) will be extracting pore water for subsequent analysis of organic COPCs by the LPR contract laboratories. Sediment cores will be sent directly from the field to Brooks Rand, LLC for extraction and analysis of mercury and methyl mercury. Sediment core collection is expected to occur over a two-week period and the sample processing (pore water extraction) is expected to be completed within one week.

Analysis Tasks: The pore water samples will be analyzed for a focused subset of Group A analytes: PCDDs/PCDFs, PCBs - homologs and congeners, PAHs, low-level total mercury and methyl mercury, TOC, and DOC. The cores that have been identified for TCLP analysis will be tested for the following parameters: TCLP SVOCs, TCLP pesticides, TCLP herbicides, TCLP mercury, and TCLP metals. Sediment samples from 6 of the 25 TCLP sediment cores will also be submitted for characterization of selected analytes (PCDD/PCDFs, PCBs, and mercury) The RM 10.9 QAPP Addendum analytical parameters will be analyzed using the same methods, and by the same laboratories, as specified in the 2011 RM 10.9 QAPP.

Quality Control Tasks: QC samples have been defined for the field and laboratory efforts. Field QC samples are summarized on Worksheet #20; laboratory QC samples are summarized on Worksheet #28.

Secondary Data: All relevant secondary/historical data are summarized on Worksheet #13.

Data Management Tasks: The handling of records and data are summarized on Worksheet #29.

Documentation and Records: Project related records (field, sample transfer/chain of custody, laboratory) are summarized on Worksheet #29.

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

Assessment/Audit Tasks: Field and laboratory audits are scheduled in accordance with Worksheet #31.

Data Review Tasks: Field data will be reviewed as described in Worksheet #34. Laboratories are contractually required to verify all laboratory data including electronic data deliverables (EDDs) as summarized in Worksheet #34. Data validation and usability assessments will be conducted as detailed in Worksheets #35, 36, and 37.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PCDD/PCDFs
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b]	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001020	17	pg/L	[1][3]	50	NA	50	6.5	**50**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268879	17	pg/L	[1][3]	50	NA	50	7.5	**50**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562394	0.5	pg/L	[1][3]	25	NA	50	**1.3**	**25**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822469	0.5	pg/L	[1][3]	25	NA	50	**3.1**	**25**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673897	0.5	pg/L	[1][3]	25	NA	50	**2**	**25**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648269	0.05	pg/L	[1][3]	25	NA	50	**2.1**	**25**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227286	0.05	pg/L	[1][3]	25	NA	50	**2.1**	**25**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117449	0.05	pg/L	[1][3]	25	NA	50	**0.96**	**25**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653857	0.05	pg/L	[1][3]	25	NA	50	**2.2**	**25**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918219	0.05	pg/L	[1][3]	25	NA	50	**1.6**	**25**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408743	0.05	pg/L	[1][3]	25	NA	50	**2.5**	**25**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117416	0.17	pg/L	[1][3]	25	NA	50	**1.8**	**25**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321764	0.005	pg/L	[1][3]	25	NA	50	**1.9**	**25**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851345	0.05	pg/L	[1][3]	25	NA	50	**1**	**25**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117314	0.017	pg/L	[1][3]	25	NA	50	**1.6**	**25**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207319	0.05	pg/L	[1][3]	5	NA	10	**1.2**	**5**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746016	0.005	pg/L	[1][3]	5	NA	10	**1.2**	**5**
Total Heptachlorodibenzofuran (HpCDF)	3898-75-3	NA	pg/L	NA	50	NA	NA	NA	50
Total Heptachlorodibenzo-p-dioxin (HpCDD)	37871-00-4	NA	pg/L	NA	50	NA	NA	NA	50
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1	NA	pg/L	NA	50	NA	NA	NA	50
Total Hexachlorodibenzo-p-dioxin (HxCDD)	34465-46-8	NA	pg/L	NA	50	NA	NA	NA	50
Total Pentachlorodibenzofuran (PeCDF)	60402-15-4	NA	pg/L	NA	50	NA	NA	NA	50
Total Pentachlorodibenzo-p-dioxin (PeCDD)	36088-22-9	NA	pg/L	NA	50	NA	NA	NA	50
Total Tetrachlorodibenzofuran (TCDF)	55722-27-5	NA	pg/L	NA	50	NA	NA	NA	50
Total Tetrachlorodibenzo-p-dioxin (TCDD)	41903-57-5	NA	pg/L	NA	50	NA	NA	NA	50

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PCB Congeners and Homologs
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b]	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 1	2051-60-7	64	pg/L	[1][2][3][4]	40	NA	200	6.73	40
PCB 2	2051-61-8	64	pg/L	[1][2][3][4]	40	NA	10	4.18	40
PCB 3	2051-62-9	64	pg/L	[1][2][3][4]	40	NA	200	6.44	40
PCB 4	13029-08-8	64	pg/L	[1][2][3][4]	60	NA	500	10.40	60
PCB 5	16605-91-7	64	pg/L	[1][2][3][4]	40	NA	50	4.60	40
PCB 6	25569-80-6	64	pg/L	[1][2][3][4]	40	NA	50	6.62	40
PCB 7	33284-50-3	64	pg/L	[1][2][3][4]	40	NA	50	3.85	40
PCB 8	34883-43-7	64	pg/L	[1][2][3][4]	60	NA	500	8.61	60
PCB 9	34883-39-1	64	pg/L	[1][2][3][4]	40	NA	50	4.60	40
PCB 10	33146-45-1	64	pg/L	[1][2][3][4]	40	NA	50	7.35	40
PCB 11	2050-67-1	64	pg/L	[1][2][3][4]	60	NA	200	36.37	60
PCB 12	2974-92-7	64	pg/L	[1][2][3][4]	60	NA	100	20.40	60
PCB 13	2974-90-5	64	pg/L	[1][2][3][4]	60	NA	100	20.40	60
PCB 14	34883-41-5	64	pg/L	[1][2][3][4]	40	NA	100	5.78	40
PCB 15	2050-68-2	64	pg/L	[1][2][3][4]	40	NA	500	10.81	40
PCB 16	38444-78-9	64	pg/L	[1][2][3][4]	40	NA	100	8.57	40
PCB 17	37680-66-3	64	pg/L	[1][2][3][4]	40	NA	200	10.95	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 18	37680-65-2	64	pg/L	[1][2][3][4]	60	NA	500	11.45	60
PCB 19	38444-73-4	64	pg/L	[1][2][3][4]	40	NA	100	9.67	40
PCB 20	38444-84-7	64	pg/L	[1][2][3][4]	40	NA	500	16.62	40
PCB 21	55702-46-0	64	pg/L	[1][2][3][4]	40	NA	200	12.64	40
PCB 22	38444-85-8	64	pg/L	[1][2][3][4]	40	NA	200	9.92	40
PCB 23	55720-44-0	64	pg/L	[1][2][3][4]	40	NA	200	3.16	40
PCB 24	55702-45-9	64	pg/L	[1][2][3][4]	40	NA	200	11.22	40
PCB 25	55712-37-3	64	pg/L	[1][2][3][4]	40	NA	200	7.67	40
PCB 26	38444-81-4	64	pg/L	[1][2][3][4]	40	NA	200	9.05	40
PCB 27	38444-76-7	64	pg/L	[1][2][3][4]	40	NA	200	5.63	40
PCB 28	7012-37-5	64	pg/L	[1][2][3][4]	40	NA	500	16.62	40
PCB 29	15862-07-4	64	pg/L	[1][2][3][4]	40	NA	200	9.05	40
PCB 30	35693-92-6	64	pg/L	[1][2][3][4]	60	NA	500	11.45	60
PCB 31	16606-02-3	64	pg/L	[1][2][3][4]	40	NA	500	10.12	40
PCB 32	38444-77-8	64	pg/L	[1][2][3][4]	40	NA	200	5.67	40
PCB 33	38444-86-9	64	pg/L	[1][2][3][4]	40	NA	200	12.64	40
PCB 34	37680-68-5	64	pg/L	[1][2][3][4]	40	NA	200	3.38	40
PCB 35	37680-69-6	64	pg/L	[1][2][3][4]	40	NA	200	9.58	40
PCB 36	38444-87-0	64	pg/L	[1][2][3][4]	40	NA	200	7.49	40
PCB 37	38444-90-5	64	pg/L	[1][2][3][4]	40	NA	500	8.96	40
PCB 38	53555-66-1	64	pg/L	[1][2][3][4]	40	NA	200	4.65	40
PCB 39	38444-88-1	64	pg/L	[1][2][3][4]	40	NA	200	7.33	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 40	38444-93-8	64	pg/L	[1][2][3][4]	40	NA	500	6.45	40
PCB 41	52663-59-9	64	pg/L	[1][2][3][4]	40	NA	500	6.45	40
PCB 42	36559-22-5	64	pg/L	[1][2][3][4]	40	NA	200	4.04	40
PCB 43	70362-46-8	64	pg/L	[1][2][3][4]	40	NA	200	9.35	40
PCB 44	41464-39-5	64	pg/L	[1][2][3][4]	40	NA	500	10.67	40
PCB 45	70362-45-7	64	pg/L	[1][2][3][4]	40	NA	200	12.06	40
PCB 46	41464-47-5	64	pg/L	[1][2][3][4]	40	NA	200	2.62	40
PCB 47	2437-79-8	64	pg/L	[1][2][3][4]	40	NA	500	10.67	40
PCB 48	70362-47-9	64	pg/L	[1][2][3][4]	40	NA	200	2.55	40
PCB 49	41464-40-8	64	pg/L	[1][2][3][4]	40	NA	500	8.53	40
PCB 50	62796-65-0	64	pg/L	[1][2][3][4]	40	NA	200	9.16	40
PCB 51	68194-04-7	64	pg/L	[1][2][3][4]	40	NA	200	12.06	40
PCB 52	35693-99-3	64	pg/L	[1][2][3][4]	40	NA	500	7.50	40
PBB 53	41464419	64	pg/L	[1][2][3][4]	40	NA	500	9.16	40
PCB 54	15968-05-5	64	pg/L	[1][2][3][4]	40	NA	500	4.69	40
PCB 55	74338-24-2	64	pg/L	[1][2][3][4]	40	NA	500	6.13	40
PCB 56	41464-43-1	64	pg/L	[1][2][3][4]	40	NA	200	4.97	40
PCB 57	70424-67-8	64	pg/L	[1][2][3][4]	40	NA	500	4.62	40
PCB 58	41464-49-7	64	pg/L	[1][2][3][4]	40	NA	500	2.76	40
PCB 59	74472-33-6	64	pg/L	[1][2][3][4]	40	NA	200	11.65	40
PCB 60	33025-41-1	64	pg/L	[1][2][3][4]	40	NA	500	4.84	40
PCB 61	33284-53-6	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 62	54230-22-7	64	pg/L	[1][2][3][4]	40	NA	200	11.65	40
PCB 63	74472-34-7	64	pg/L	[1][2][3][4]	40	NA	500	4.77	40
PCB 64	52663-58-8	64	pg/L	[1][2][3][4]	40	NA	200	4.99	40
PCB 65	33284-54-7	64	pg/L	[1][2][3][4]	40	NA	500	10.67	40
PCB 66	32598-10-0	64	pg/L	[1][2][3][4]	40	NA	500	12.05	40
PCB 67	73575-53-8	64	pg/L	[1][2][3][4]	40	NA	500	5.69	40
PCB 68	73575-52-7	64	pg/L	[1][2][3][4]	40	NA	500	3.86	40
PCB 69	60233-24-1	64	pg/L	[1][2][3][4]	40	NA	500	8.53	40
PCB 70	32598-11-1	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40
PCB 71	41464-46-4	64	pg/L	[1][2][3][4]	40	NA	500	6.45	40
PCB 72	41464-42-0	64	pg/L	[1][2][3][4]	40	NA	500	3.67	40
PCB 73	74338-23-1	64	pg/L	[1][2][3][4]	40	NA	500	9.35	40
PCB 74	32690-93-0	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40
PCB 75	32598-12-2	64	pg/L	[1][2][3][4]	40	NA	500	11.65	40
PCB 76	70362-48-0	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40
PCB 77	32598-13-3	50	pg/L	[1][3]	40	NA	500	4.36	40
PCB 78	70362-49-1	64	pg/L	[1][2][3][4]	40	NA	500	4.43	40
PCB 79	41464-48-6	64	pg/L	[1][2][3][4]	40	NA	500	3.15	40
PCB 80	33284-52-5	64	pg/L	[1][2][3][4]	40	NA	500	3.59	40
PCB 81	70362-50-4	17	pg/L	[1][3]	40	NA	500	3.41	**40**
PCB 82	52663-62-4	64	pg/L	[1][2][3][4]	40	NA	500	8.29	40
PCB 83	60145-20-2	64	pg/L	[1][2][3][4]	40	NA	500	9.28	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 84	52663-60-2	64	pg/L	[1][2][3][4]	40	NA	500	5.97	40
PCB 85	65510-45-4	64	pg/L	[1][2][3][4]	40	NA	500	8.37	40
PCB 86	55312-69-1	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 87	38380-02-8	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 88	55215-17-3	64	pg/L	[1][2][3][4]	40	NA	500	7.37	40
PCB 89	73575-57-2	64	pg/L	[1][2][3][4]	40	NA	500	5.57	40
PCB 90	68194-07-0	64	pg/L	[1][2][3][4]	40	NA	500	4.70	40
PCB 91	68194-05-8	64	pg/L	[1][2][3][4]	40	NA	500	7.37	40
PCB 92	52663-61-3	64	pg/L	[1][2][3][4]	40	NA	500	3.67	40
PCB 93	73575-56-1	64	pg/L	[1][2][3][4]	40	NA	500	7.55	40
PCB 94	73575-55-0	64	pg/L	[1][2][3][4]	40	NA	500	4.51	40
PCB 95	38379-99-6	64	pg/L	[1][2][3][4]	40	NA	500	6.75	40
PCB 96	73575-54-9	64	pg/L	[1][2][3][4]	40	NA	500	2.64	40
PCB 97	41464-51-1	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 98	60233-25-2	64	pg/L	[1][2][3][4]	40	NA	500	12.09	40
PCB 99	38380-01-7	64	pg/L	[1][2][3][4]	40	NA	500	17.70	40
PCB 100	39485-83-1	64	pg/L	[1][2][3][4]	40	NA	500	7.55	40
PCB 101	37680-73-2	64	pg/L	[1][2][3][4]	40	NA	1000	4.70	40
PCB 102	68194-06-9	64	pg/L	[1][2][3][4]	40	NA	500	12.09	40
PCB 103	60145-21-3	64	pg/L	[1][2][3][4]	40	NA	500	2.52	40
PCB 104	56558-16-8	64	pg/L	[1][2][3][4]	40	NA	500	5.75	40
PCB 105	32598-14-4	167	pg/L	[1][3]	40	NA	200	4.45	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 106	70424-69-0	64	pg/L	[1][2][3][4]	40	NA	500	5.80	40
PCB 107	70424-68-9	64	pg/L	[1][2][3][4]	40	NA	200	3.72	40
PCB 108	70362-41-3	64	pg/L	[1][2][3][4]	40	NA	1000	22.86	40
PCB 109	74472-35-8	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 110	38380-03-9	64	pg/L	[1][2][3][4]	40	NA	1000	7.25	40
PCB 111	39635-32-0	64	pg/L	[1][2][3][4]	40	NA	1000	3.43	40
PCB 112	74472-36-9	64	pg/L	[1][2][3][4]	40	NA	1000	17.70	40
PCB 113	68194-10-5	64	pg/L	[1][2][3][4]	40	NA	1000	4.70	40
PCB 114	74472-37-0	167	pg/L	[1][3]	40	NA	500	4.67	40
PCB 115	74472-38-1	64	pg/L	[1][2][3][4]	40	NA	1000	7.25	40
PCB 116	18259-05-7	64	pg/L	[1][2][3][4]	40	NA	200	8.37	40
PCB 117	68194-11-6	64	pg/L	[1][2][3][4]	40	NA	200	8.37	40
PCB 118	31508-00-6	167	pg/L	[1][3]	40	NA	500	6.27	40
PCB 119	56558-17-9	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 120	68194-12-7	64	pg/L	[1][2][3][4]	40	NA	500	3.45	40
PCB 121	56558-18-0	64	pg/L	[1][2][3][4]	40	NA	500	3.45	40
PCB 122	76842-07-4	64	pg/L	[1][2][3][4]	40	NA	500	4.58	40
PCB 123	65510-44-3	167	pg/L	[1][3]	40	NA	500	5.04	40
PCB 124	70424-70-3	64	pg/L	[1][2][3][4]	40	NA	1000	22.86	40
PCB 125	74472-39-2	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 126	57465-28-8	0.05	pg/L	[1][3]	40	NA	500	**2.16**	**40**
PCB 127	39635-33-1	64	pg/L	[1][2][3][4]	40	NA	1000	6.56	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 128	38380-07-3	64	pg/L	[1][2][3][4]	40	NA	500	10.78	40
PCB 129	55215-18-4	64	pg/L	[1][2][3][4]	40	NA	500	8.91	40
PCB 130	52663-66-8	64	pg/L	[1][2][3][4]	40	NA	500	8.69	40
PCB 131	61798-70-7	64	pg/L	[1][2][3][4]	40	NA	500	1.27	40
PCB 132	38380-05-1	64	pg/L	[1][2][3][4]	40	NA	500	4.62	40
PCB 133	35694-04-3	64	pg/L	[1][2][3][4]	40	NA	500	2.67	40
PCB 134	52704-70-8	64	pg/L	[1][2][3][4]	40	NA	500	10.43	40
PCB 135	52744-13-5	64	pg/L	[1][2][3][4]	40	NA	500	6.28	40
PCB 136	38411-22-2	64	pg/L	[1][2][3][4]	40	NA	200	3.36	40
PCB 137	35694-06-5	64	pg/L	[1][2][3][4]	40	NA	1000	3.50	40
PCB 138	35065-28-2	64	pg/L	[1][2][3][4]	40	NA	500	8.91	40
PCB 139	56030-56-9	64	pg/L	[1][2][3][4]	40	NA	500	4.37	40
PCB 140	59291-64-4	64	pg/L	[1][2][3][4]	40	NA	500	4.37	40
PCB 141	52712-04-6	64	pg/L	[1][2][3][4]	40	NA	200	3.77	40
PCB 142	41411-61-4	64	pg/L	[1][2][3][4]	40	NA	1000	4.40	40
PCB 143	68194-15-0	64	pg/L	[1][2][3][4]	40	NA	500	10.43	40
PCB 144	68194-14-9	64	pg/L	[1][2][3][4]	40	NA	500	5.50	40
PCB 145	74472-40-5	64	pg/L	[1][2][3][4]	40	NA	1000	3.12	40
PCB 146	51908-16-8	64	pg/L	[1][2][3][4]	40	NA	500	4.91	40
PCB 147	68194-13-8	64	pg/L	[1][2][3][4]	40	NA	500	4.52	40
PCB 148	74472-41-6	64	pg/L	[1][2][3][4]	40	NA	1000	5.00	40
PCB 149	38380-04-0	64	pg/L	[1][2][3][4]	40	NA	1000	4.52	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 150	68194-08-1	64	pg/L	[1][2][3][4]	40	NA	1000	3.41	40
PCB 151	52663-63-5	64	pg/L	[1][2][3][4]	40	NA	500	6.28	40
PCB 152	68194-09-2	64	pg/L	[1][2][3][4]	40	NA	1000	2.30	40
PCB 153	35065-27-1	64	pg/L	[1][2][3][4]	40	NA	500	7.11	40
PCB 154	60145-22-4	64	pg/L	[1][2][3][4]	40	NA	500	4.88	40
PCB 155	33979-03-2	64	pg/L	[1][2][3][4]	40	NA	1000	3.16	40
PCB 156	38380-08-4	167	pg/L	[1][3]	40	NA	500	4.48	40
PCB 157	69782-90-7	167	pg/L	[1][3]	40	NA	500	4.48	40
PCB 158	74472-42-7	64	pg/L	[1][2][3][4]	40	NA	200	2.46	40
PCB 159	39635-35-3	64	pg/L	[1][2][3][4]	40	NA	1000	3.38	40
PCB 160	41411-62-5	64	pg/L	[1][2][3][4]	40	NA	500	7.22	40
PCB 161	74472-43-8	64	pg/L	[1][2][3][4]	40	NA	1000	2.62	40
PCB 162	39635-34-2	64	pg/L	[1][2][3][4]	40	NA	1000	4.07	40
PCB 163	74472-44-9	64	pg/L	[1][2][3][4]	40	NA	500	8.91	40
PCB 164	74472-45-0	64	pg/L	[1][2][3][4]	40	NA	500	3.50	40
PCB 165	74472-46-1	64	pg/L	[1][2][3][4]	40	NA	1000	4.06	40
PCB 166	41411-63-6	64	pg/L	[1][2][3][4]	40	NA	500	10.78	40
PCB 167	52663-72-6	167	pg/L	[1][3]	40	NA	500	4.96	40
PCB 168	59291-65-5	64	pg/L	[1][2][3][4]	40	NA	500	7.11	40
PCB 169	32774-16-6	0.167	pg/L	[1][3]	40	NA	500	**3.63**	**40**
PCB 170	35065-30-6	64	pg/L	[1][2][3][4]	40	NA	500	2.91	40
PCB 171	52663-71-5	64	pg/L	[1][2][3][4]	40	NA	1000	7.80	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 172	52663-74-8	64	pg/L	[1][2][3][4]	40	NA	1000	3.37	40
PCB 173	68194-16-1	64	pg/L	[1][2][3][4]	40	NA	1000	7.80	40
PCB 174	38411-25-5	64	pg/L	[1][2][3][4]	40	NA	500	6.46	40
PCB 175	40186-70-7	64	pg/L	[1][2][3][4]	40	NA	1000	5.63	40
PCB 176	52663-65-7	64	pg/L	[1][2][3][4]	40	NA	1000	2.20	40
PCB 177	52663-70-4	64	pg/L	[1][2][3][4]	40	NA	500	2.24	40
PCB 178	52663-67-9	64	pg/L	[1][2][3][4]	40	NA	500	2.88	40
PCB 179	52663-64-6	64	pg/L	[1][2][3][4]	40	NA	500	2.47	40
PCB 180	35065-29-3	64	pg/L	[1][2][3][4]	40	NA	500	7.77	40
PCB 181	74472-47-2	64	pg/L	[1][2][3][4]	40	NA	1000	5.44	40
PCB 182	60145-23-5	64	pg/L	[1][2][3][4]	40	NA	1000	3.59	40
PCB 183	52663-69-1	64	pg/L	[1][2][3][4]	40	NA	1000	4.27	40
PCB 184	74472-48-3	64	pg/L	[1][2][3][4]	40	NA	1000	3.31	40
PCB 185	52712-05-7	64	pg/L	[1][2][3][4]	40	NA	1000	4.27	40
PCB 186	74472-49-4	64	pg/L	[1][2][3][4]	40	NA	1000	4.18	40
PCB 187	52663-68-0	64	pg/L	[1][2][3][4]	40	NA	500	4.50	40
PCB 188	74487-85-7	64	pg/L	[1][2][3][4]	40	NA	500	4.32	40
PCB 189	39635-31-9	167	pg/L	[1][3]	40	NA	500	2.80	40
PCB 190	41411-64-7	64	pg/L	[1][2][3][4]	40	NA	500	2.46	40
PCB 191	74472-50-7	64	pg/L	[1][2][3][4]	40	NA	1000	3.13	40
PCB 192	74472-51-8	64	pg/L	[1][2][3][4]	40	NA	1000	3.67	40
PCB 193	69782-91-8	64	pg/L	[1][2][3][4]	40	NA	500	7.77	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

PCB 194	35694-08-7	64	pg/L	[1][2][3][4]	40	NA	500	4.98	40
PCB 195	52663-78-2	64	pg/L	[1][2][3][4]	40	NA	1000	6.21	40
PCB 196	42740-50-1	64	pg/L	[1][2][3][4]	40	NA	1000	6.18	40
PCB 197	33091-17-7	64	pg/L	[1][2][3][4]	40	NA	1000	5.59	40
PCB 198	68194-17-2	64	pg/L	[1][2][3][4]	40	NA	500	12.97	40
PCB 199	52663-75-9	64	pg/L	[1][2][3][4]	40	NA	500	12.97	40
PCB 200	52663-73-7	64	pg/L	[1][2][3][4]	40	NA	1000	5.59	40
PCB 201	40186-71-8	64	pg/L	[1][2][3][4]	40	NA	1000	4.29	40
PCB 202	2136-99-4	64	pg/L	[1][2][3][4]	40	NA	1000	3.91	40
PCB 203	52663-76-0	64	pg/L	[1][2][3][4]	40	NA	1000	4.91	40
PCB 204	74472-52-9	64	pg/L	[1][2][3][4]	40	NA	1000	3.06	40
PCB 205	74472-53-0	64	pg/L	[1][2][3][4]	40	NA	1000	5.50	40
PCB 206	40186-72-9	64	pg/L	[1][2][3][4]	40	NA	1000	3.17	40
PCB 207	52663-79-3	64	pg/L	[1][2][3][4]	40	NA	1000	2.68	40
PCB 208	52663-77-1	64	pg/L	[1][2][3][4]	40	NA	1000	3.49	40
PCB 209	2051-24-3	64	pg/L	[1][2][3][4]	40	NA	500	2.47	40
Monochlorobiphenyl	27323-18-8	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Dichlorobiphenyl	25512-42-9	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Trichlorobiphenyl	25323-68-6	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Tetrachlorobiphenyl	26914-33-0	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Pentachlorobiphenyl	25429-29-2	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Hexachlorobiphenyl	26601-64-9	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

Heptachlorobiphenyl	28655-71-2	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Octachlorobiphenyl	55722-26-4	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Nonachlorobiphenyl	53742-07-7	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PAHs and alkyl PAHs by LRMS-SIM isotope dilution
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b]	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
1-Methylnaphthalene	90120	2100	ng/L	[11]	10	NA	NA	4.1	10
1-Methylphenanthrene	832699	1100000	ng/L	[6]	10	NA	NA	0.7	10
2,3,5-Trimethylnaphthalene	2245387	140	ng/L	[6]	10	NA	NA	1.6	10
2,6-Dimethylnaphthalene	581420	140	ng/L	[6]	10	NA	NA	2.2	10
2-Methylnaphthalene	91576	15000	ng/L	[6]	20	NA	NA	8.3	20
Acenaphthene	83329	220000	ng/L	[6]	10	NA	NA	2.4	10
Acenaphthylene	208968	220000	ng/L	[6]	10	NA	NA	0.15	10
Anthracene	120127	730	ng/L	[11]	10	NA	NA	0.71	10
Fluorene	86737	3900	ng/L	[11]	10	NA	NA	1.5	10
Naphthalene	91203	140	ng/L	[6]	50	NA	NA	16	50
Phenanthrene	85018	1100000	ng/L	[6]	20	NA	NA	11	20
Benzo[a]anthracene	56553	3.8	ng/L	[3]	10	NA	NA	1.5	**10**
Benzo[a]pyrene	50328	2.9	ng/L	[6]	10	NA	NA	0.4	**10**
Benzo[b]fluoranthene	205992	3.8	ng/L	[3]	10	NA	NA	1.5	**10**
Benzo[e]pyrene	192972	200	ng/L	[5]	10	NA	NA	1.4	10
Benzo[g,h,i]perylene	191242	110000	ng/L	[6]	10	NA	NA	0.51	10

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

Benzo[k]fluoranthene	207089	3.8	ng/L	[3]	10	NA	NA	1	**10**
Chrysene	218019	3.8	ng/L	[3]	10	NA	NA	0.22	**10**
Dibenzo[a,h]anthracene	53703	2.9	ng/L	[6]	10	NA	NA	0.78	**10**
Dibenzothiophene	132650	NA	ng/L	NA	10	NA	NA	0.69	10
Fluoranthene	206440	130000	ng/L	[1][3]	10	NA	NA	2.4	10
Indeno(1,2,3-cd)pyrene	193395	3.8	ng/L	[3]	10	NA	NA	1	**10**
Perylene	198550	110000	ng/L	[6]	10	NA	NA	0.81	10
Pyrene	129000	110000	ng/L	[6]	10	NA	NA	1.7	10
C1-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Fluorenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Phenanthrene/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Pyrene/fluoranthenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Fluorenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Phenanthrene/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Fluorenes	NA	NA	ng/L	NA	10	NA	NA	10	10

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

C3-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Phenanthrene/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C4-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C4-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C4-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C4-Phenanthrenes/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: Mercury and Methyl Mercury
Concentration Level: Low

Analyte	CAS Number	Laboratory SOP[f]	PAL[a]	Units	PAL Source[a]	Project QL[b]	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
							MDLs	Method QLs	MDLs	QLs
Mercury	7439976	B-1	50	ng/L	[1]	1	NA	NA	0.15	0.4
Methyl mercury	22967926	B-2	2.8	ng/L	[11]	0.05	NA	0.02	0.02	0.05

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: General Chemistry
Concentration Level: Low

Analyte	CAS Number	Laboratory SOP[f]	PAL[a]	Units	PAL Source[a]	Project QL[b]	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
							MDLs	Method QLs	MDLs	QLs
Total Organic Carbon (TOC)	NA	C-13	NA	ug/L	NA	300	NA	NA	30	300
Dissolved Organic Carbon (DOC)	NA	C-13	NA	ug/L	NA	300	NA	NA	100	300

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.2) Data Quality Levels and Analytical Method Evaluation

[a] Project Action Limits (PALs) are based on the lower of:
[1] NJDEP (2008) Human Health Surface Water Quality Level - freshwater
[2] NJDEP (2008) Human Health Surface Water Quality Level - saline water
[3] USEPA (2009a) Ambient Water Quality Criterion for consumption of water and organisms
[4] USEPA (2009a) Ambient Water Quality Criterion for consumption of organisms
[5] USEPA (2011a) Maximum Contaminant Levels (MCLs)
[6] USEPA (2011b) Regional Screening Values (RSLs) for tap water
[7] NJDEP (2008) Chronic Aquatic Life Surface Water Quality Level - freshwater
[8] NJDEP (2008) Chronic Aquatic Life Surface Water Quality Level - saline water
[9] USEPA (2009a) Chronic Aquatic Life Ambient Water Quality Criterion - freshwater
[10] USEPA (2009a) Chronic Aquatic Life Ambient Water Quality Criterion - saltwater
[11] Tier II chronic values (Suter and Tsao, 1996)

[b] Project QLs are equivalent to the Achievable Laboratory Quantitation Limits.

[c] Analytical MDLs and QLs are those documented in validated methods.

[d] Achievable MDLs and QLs are limits that the selected laboratory can achieve when performing the specified methods (Worksheet #23) with nominal sample volumes in the absence of interferences. Actual MDLs and QLs will vary based on sample specific factors. QLs listed for PCBs are equivalent to the Minimum Level (ML) per reference method definitions and may not be based on the low point of calibration. EDLs for isotope dilution methods are based on average blank EDL results. The actual reporting limits for isotope dilution methods will be the sample specific EDL rather than QL. All results between the MDL (or EDL) and QL will be reported as estimated values (J qualifier). The reporting limit will be the QL for all methods except isotope dilution methods.

[e] Achievable laboratory limits that are greater than the PALs are presented in boldface text.

[f] Refer to Worksheet #23 for Laboratory SOPs.

QAPP Worksheet #16 (UFP-QAPP Manual Section 2.8.2) Project Sch/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Project Status	de maximis, inc.	Monthly	Monthly	Progress report	15th of each month
Planning and Development of Study Objectives	de maximis, inc. / CH2M HILL	December 2012	December 2012	QAPP Addendum D	December 2012
Collection of Samples and Submission for Analysis	CH2M HILL	February 2013	February 2013	Sample submission to laboratories	At time of collection
Laboratory Analysis	CH2M HILL	February 2013	March 2013	Analytical data to CPG	Approximately 30 days after collection. See Worksheet #30 (RM 10.9 QAPP and RM 10.9 Addendum D) for turnaround times.
Preparation and Delivery of Sampling Report to USEPA	de maximis, inc. / CH2M HILL	April 2013	May 2013	Additional Investigation Report	May 2013

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

Sediment core locations for pore water characterization within the cap area were selected to correspond to the locations with the 10 highest concentrations of PCDDs/PCDFs, PCBs, and mercury encountered in the sediment within the 2 to 4 ft interval, as determined during the 2011 RM 10.9 Characterization Program. These locations also include 9 of the top 10 highest concentration HMW PAH and 8 of the top 10 highest concentration LMW PAH locations. To select these locations, an average concentration within the 1.5 to 3.5 ft interval for each of the select COPCs (PCDDs/PCDFs, PCBs, and mercury) was calculated for the 25 locations within the cap area. Data from the 1.5 to 3.5 ft interval, was collected during the 2011 RM 10.9 Characterization Program, are representative of the 2 to 4 ft interval below the dredge area. Each location and COPC was then ranked from 1 as the highest average concentration to 25 the lowest average concentration. The results are presented in Tables 3 and 4 for mercury and the organic COPCs, respectively. Since the top 10 highest concentration locations for each COPC were not exactly co-located, the sampling program includes a total of 13 separate locations for the collection of sediments for pore water characterization.

To obtain both the required number of samples and adequate spatial coverage of the Removal Area for disposal purposes, sediment core locations for TCLP characterization include: 1) locations previously characterized for sediment COPC concentrations and 2) locations in areas outside those previously characterized. Of the 25 TCLP core locations, 6 were selected for spatial distribution over the Removal Area for additional chemical characterization.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Station Location		Previous Characterization/Siting Rationale					Target Core Length/Analyses			NAD 83 NJ State Plane Ft	
River Mile	Station ID	Water Depth NGVD ft	Geomorphic region	Surficial sediment type	Subsurface sediment type	Siting rationale	Estimated interval below sediment surface (ft)	Rationale for Target Length	Parameters[1, 2, 3]	Easting	Northing
10.78	RM10.9D-0312	<6	nearshore	Silt	silt over sand	Pore Water Characterization TCLP & Chemical Characterization	2-4 ft 0-2 ft 0-2 ft	Under Cap	Pore Water Analytes: Organics Sediment TCLP and Chemical	592634	722682
10.80	RM10.9D-0314	<6	nearshore	Silt	silt over sand	Pore Water Characterization TCLP Characterization Sediment Stabilization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics & Mercury Sediment TCLP	592685	722762
10.82	RM10.9D-0316	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP Characterization	2-4 ft 0-2 ft 0-2 ft	Under Cap	Pore Water Analytes: Organics Sediment TCLP	592732	722847

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

10.84	RM10.9D-0318	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP Characterization Sediment Stabilization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics Sediment TCLP	592780	722927
10.86	RM10.9D-0322	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP & Chemical Characterization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics Sediment TCLP and Chemical	592826	723010
10.94	RM10.9D-0333	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP & Chemical Characterization Sediment Stabilization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics & Mercury Sediment TCLP and Chemical	593159	723254

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

10.97	RM10.9D-0338	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP Characterization Sediment Stabilization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics & Mercury Sediment TCLP	593298	723334
10.99	RM10.9D-0339	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP Characterization Sediment Stabilization	2-4 ft 0-2 ft 0-2 ft	Under Cap	Pore Water Analytes: Organics Sediment TCLP	593394	723336
11.00	RM10.9D-0340	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP Characterization	2-4 ft 0-2 ft 0-2 ft	Under Cap	Pore Water Analytes: Organics Sediment TCLP	593487	723336
11.02	RM10.9D-0343	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP Characterization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics & Mercury Sediment TCLP	593533	723419

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

11.04	RM10.9D-0344	<6	point bar	Silt	silt over sand	Pore Water Characterization TCLP & Chemical Characterization Sediment Stabilization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics Sediment TCLP and Chemical	593630	723419
11.08	RM10.9D-0350	<10	point bar	silt, sand, gravel	silt, sand, gravel	Pore Water Characterization TCLP Characterization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics & Mercury Sediment TCLP	593868	723496
11.10	RM10.9D-0351	<6	side channel	Silt	silt over sand	Pore Water Characterization TCLP & Chemical Characterization Sediment Stabilization Mercury Treatability	2-4 ft 0-2 ft 0-2 ft 2-4 ft	Under Cap	Pore Water Analytes: Organics & Mercury Sediment TCLP and Chemical	593960	723499
10.77	RM10.9D-T01	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	592585	722612
10.8	RM10.9D-T02	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	592848	723069
10.87	RM10.9D-T03	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	592942	723037

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

10.89	RM10.9D-T04	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	592956	723138
10.90	RM10.9D-T05	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	593045	723091
10.93	RM10.9D-T06	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	593199	723174
10.96	RM10.9D-T07	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	593299	723253
11.06	RM10.9D-T08	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	593770	723450
11.13	RM10.9D-T09	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	594081	723541
11.16	RM10.9D-T10	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	594241	723590
11.18	RM10.9D-T11	NA	NA	NA	NA	TCLP Characterization	0-2 ft	Dredge Material	TCLP Analytes	594423	723642
11.22	RM10.9D-T12	NA	NA	NA	NA	TCLP & Chemical Characterization	0-2 ft	Dredge Material	Sediment TCLP and Chemical	594606	723705

Notes:

[1] Pore Water Samples to be analyzed for:

- PCDDs/PCDFs
- PCBs (homologs and congeners)
- PAHs and alkyl PAHs
- Total and dissolved mercury and methyl mercury
- Total and dissolved organic carbon

[2] Sediment TCLP Samples to be analyzed for:

- TCLP SVOCs
- TCLP organochlorine pesticides
- TCLP chlorinated herbicides
- TCLP mercury

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

- TCLP metals
-

[3] Sediment Chemical Samples to be analyzed for:

- PCDDs/PCDFs
- PCBs (homologs and congeners)
- Mercury

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
Water	PCDD/PCDFs	Low	A-1	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	365 days for preparation and analysis
Water	PCBs (Homologs and Congeners)	Low	T-5,T-6	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	365 days for preparation and analysis
Water	PAHs/Alkyl PAHs (LRMS-SIM)	Low	T-3, T-4	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	Low Level Mercury	Low	B-1	500 mL	2 x 250mL PTFE with PTFE-lined lids	4±2°C during shipment; Samples must be preserved or analyzed within 48 hours of collection. Samples will be oxidized by addition of 5mL/L BrCl to original sampling container. Oxidation of the sample within the original container will extend the time to preservation to 28 days	28 days to analysis if preserved 48 hours to analysis if unpreserved
Water	Low Level Mercury (dissolved)	Low	B-1	500 mL	2 x 250mL PTFE with PTFE-lined lids	Field filter (0.45 um) and 4±2°C during shipment; Samples must be preserved or analyzed within 48 hours of collection. Samples will be oxidized by addition of 5mL/L BrCl to original sampling container. Oxidation of the sample within the original container will extend the time to preservation to 28 days.	28 days to analysis if preserved 48 hours to analysis if unpreserved

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Water	Methyl Mercury	Low	B-2	500 mL	2 x 250mL PTFE with PTFE-lined lids	Preserve at collection with 0.2% (volume to volume [v/v]) 18 Molar (M) sulfuric acid (H_2SO_4); store in the dark; at 4±2ºC.	90 days to analysis if preserved 48 hours to analysis if unpreserved
Water	Methyl Mercury (dissolved)	Low	B-2	500 mL	2 x 250mL PTFE with PTFE-lined lids	Field filter (0.45 um) and preserve at collection with 0.2% (v/v) 18 M H_2SO_4; store in the dark; at 4±2ºC.	90 days to analysis 48 hours to analysis if unpreserved
Water	TOC	Low	C-13	120 mL	3 x 40mL amber glass vials with PTFE-lined lids	4±2□ C; H_2SO_4 to pH < 2	28 days to analysis
Water	DOC	Low	C-13, C-16	600 mL	3 x 200mL plastic	4±2°C	Ship to the laboratory and filter using a 0.7um glass fiber filter within 48 hours. Filters and filtrates must be analyzed within 28 days

[a] Refer to Worksheet #23 for SOP titles and methods

[b] Sample size is the minimum requested by each laboratory to perform the requested analysis; minimum sample size requirements reflect the additional sample needed to permit re-extraction and re-analysis . Additional sample volume is needed for field QC samples (e.g., matrix spikes).

QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference[a]	No. of Composite Samples	No. of Duplicates[b]	Total No. of Samples to Lab
Water	PCDD/PCDFs	Low	A-1	2	1	3
Water	PCBs (Homologs and Congeners)	Low	T-5, T-6	2	1	3
Water	PAHs and Alkyl PAHs - LRMS-SIM	Low	T-3, T-4	2	1	3
Water	Low Level Mercury and Methyl mercury	Low	B-1	2	1	3
Water	TOC and DOC	Low	C-13	2	1	3

a. Refer to Worksheet #23 for SOP title and method

b. Duplicate samples will be prepared if sufficient pore water volume is generated by the laboratory.

QAPP Worksheet #21 (UFP-QAPP Manual Section 3.1.2) Project Sampling SOP References Table

The following is a list of the SOPs which are modified as described on this worksheet for the RM 10.9 QAPP Addendum. Refer to the RM 10.9 QAPP Worksheet #21 for other pertinent SOPs.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
LPR-G-06	Packaging and shipping	CH2M HILL	NA	Yes[1]	2011 RM 10.9 Characterization QAPP Appendix B[1]
LPR-S-04	Sediment core processing	CH2M HILL	NA	Yes[2 & 3]	2011 RM 10.9 Characterization QAPP Appendix B[2,3,4]

[1] VOCs will not be collected, so Section 5.2.15 will be modified to not require sample shipping by the close of the same day the samples were collected.

[2] Sediment cores will be capped and sealed upon collection to preserve pore water content as follows: Cap and tape the lower end. If a lined aluminum tube is used, remove the nose piece rivets, slide the liner out (downward) until the sediment/water interface is visible through the liner wall. Drill a small hole just above the interface to drain off all water above the sediment core. Carefully cut off the liner at this hole, capping and taping it to seal the tube at both ends. Sample tubes are to be sealed with wax and capped with plastic end caps secured by duct tape or other appropriate methods.

[3] Sediment cores for TCLP and chemical analysis will be individually composited. Each 2-ft core segment will be thoroughly mixed (homogenized) with a decontaminated scoop, shovel, electric drill mixing paddles, or other similar implement until color and texture differences are no longer detected. The sediment will then be transferred into laboratory provided containers for chemical analyses.

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

The following is a list of SOPs for aqueous samples, which were not included in the RM 10.9 QAPP. Refer to the RM 10.9 QAPP Worksheet #23 for other pertinent SOPs.

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
T-7	EPA 3520C[d]	Extraction and Cleanup of Organic Compounds from Waters Solids, Tissues and Wipes, PT-OP-001, Rev. 13, 3/11/2011	N/A	Organics (Sample Preparation)	N/A	TestAmerica-Pittsburgh, PA	N
C-3	EPA 3010A[d]	Metals Digestion, MET-3010A, Rev. 10, 7/12/2007	N/A	Metals (Sample Preparation-Aqueous)	N/A	CAS-Kelso, WA	N
T-4	CARB 429[e]	Isotope Dilution Analysis of Selected Semivolatile Organic Compounds and Alkylated PAHs by Gas Chromatography/Mass Spectrometry-Selected Ion Monitoring (GC/MS-SIM), KNOX-ID-0016, Rev. 8, 8/13/2010	Definitive	Organics (PAHs)	High Resolution Gas Chromatography, Low Resolution Mass Spectrometry via Selected Ion Monitoring (HRGC/LRMS-SIM)	TestAmerica-Knoxville, TN	N
T-5	EPA 1668A[f]	Extraction of Polychlorinated Biphenyl (PCB) Isomers for Analysis by Isotope Dilution HRGC/HRMS, KNOX-OP-0021, Rev. 1, 2/1/2011	Definitive	Organics (Sample Preparation)	N/A	TestAmerica-Knoxville, TN	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

T-6	EPA 1668A[f]	Analysis of Polychlorinated Biphenyl (PCB) Isomers by Isotope Dilution HRGC/HRMS, KNOX-ID-0013, Rev. 9, 1/7/2010	Definitive	Organics (PCB Congeners)	HRGC/ High Resolution Mass Spectrometry (HRMS)	TestAmerica-Knoxville	N
B-2	EPA 1630[f]	Determination of Methyl Mercury by Aqueous Phase Ethylation, Trap Pre-Collection, Isothermal GC Separation, and CVAFS Detection: BRL Procedure for EPA Method 1630 (Aqueous Samples) and EPA Method 1630, Modified (Solid Samples), BR-0011, Rev. 013c, 5/24/2010	Definitive	Metals (Methyl Mercury)	CVAFS	Brooks Rand-Seattle, WA	N
A-2	EPA 1613B	PCDD/Fs in Water by SPE AP-SP-E5, Rev.10, 10/12/2008	Definitive	Organics (Sample Preparation)	N/A	Analytical Perspectives, NC	N
A-1	EPA 1613B	Polychlorinated Dibenzodioxin/ Furans USEPA Methods 8290,1613, 23, 0023A, and TO-9A, AP-CM-5, Rev.15, 9/02/2010	Definitive	Organics (PCDD/PCDFs)	Isotope Dilution Mass Spectrometry	Analytical Perspectives, NC	N
B-1	EPA 1631	Procedure for EPA Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, BR-0006, Rev. 004e, 5/24/2010	Definitive	Metals (Total Low Level Mercury)	Cold Vapor Atomic Fluorescence (CVAFS)	Brooks Rand-Seattle, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

C-13	SM 5310C	Total / Dissolved Organic Carbon in Water, GEN-TOC, Rev. 11, 2/19/2010	Definitive	General Chemistry	TOC Analyzer (Persulfate Oxidation Method)	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

[a] All SOPs are contained in Appendix C-1of the AECOM 2010 Water Column Monitoring QAPP.

[b] Complete references are provided in Attachment 1 of the AECOM 2010 Water Column Monitoring QAPP.

[c] It is expected that the procedures outlined in these SOPs will be followed. Procedural modifications to individual SOPs may be warranted depending upon an individual sample matrix, interferences encountered, or limitations imposed by the procedure. Deviations from individual SOPs will be documented in the laboratory records. Substantive modification to any SOP will be approved in advance by the Project QA Manager and CWCM Task Manager and communicated to the CPG Coordinator and to the USEPA Remedial Project Manager for pre-approval before implementation. Examples of substantive modifications include changes to QA/QC requirements or control limits, changes other than required dilutions that affect sensitivity, and any changes that adversely affect the selectivity of the analyte detection. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity. Note the laboratory SOPs may contain default control limits, which are superseded by statistically derived control limits. If current statistically derived QC control limits are available; these current QC control limits are presented in Worksheet #12 and Worksheet #28 in place of the default limits presented in the SOPs, or presented in Attachment C-2 and incorporated by reference. Note laboratory updates to statistical control limits may occur during program execution.

[d] USEPA 2008a

[e] CARB 1997

[f] USEPA 2010b

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference [a]
Isotope Dilution Mass Spectrometry (PCDD/PCDFs)	Perfluorokerosene (PFK) Tune; initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Continuing calibration minimum every 12 hours	%RSD for mean response of unlabeled standards ≤ 10%; labeled reference compounds ± 20% Continuing calibration using Batch Control Spike (BCS_3) per SOP. Refer to Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP for IPR criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	A-1
HRGC/HRMS (PCB Congeners and Homologs)	Retention time calibration, initial calibration, continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Calibration verification minimum every 12 hours	ICAL %RSD ≤ 20% for target analytes calculated by isotope dilution. ICV %D < 50% for all targets and <35% for all but 4 target analytes %RSD ≤ 35% for target analytes calculated by internal standard. CCV ≤ 30% Drift for Toxics and LOC congeners CCV 40-160% for non-Toxic congeners. Refer to Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP for IPR and VER criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-6

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

HRGC/LRMS-SIM (PAH and Alkyl PAHs)	DFTPP tune; Initial and Continuing Calibration as required in SOP	Verify tune every 12 hours using perfluorotributylamine; Initial calibration after instrument set up, after major maintenance, and/or instrument changes have occurred	ICAL %RSD ≤30% CCV %D ≤30%. ICV %D ≤30%.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-4
CVAFS (Mercury)	Initial and continuing calibration per SOP	Calibrate daily with a calibration blanks (CB) (1 per split bottle/bubbler used), minimum of 5 standards, and ICV daily. Analyze CCV every 10 samples. Analyze carryover blank following any result ≥20,000 pg.	CB: each ≤40 pg; average ≤20 pg; standard deviation ≤7.5 pg ICV 85 -115% CCV 77-123% (total mercury) Carryover blank: ≤40 pg and within ± 20 pg of average CB	Inspect system, correct problem, rerun calibration and affected samples	Analyst	B-1
CVAFS (Methyl Mercury)	Initial and continuing calibration per SOP	Calibrate daily with ethylation blanks, minimum of 5 standards, and ICV daily. Analyze CCV every 10 samples. Analyze carryover blank following any result ≥2x the concentration of the high calibration standard	Ethylation Blank: <QL ICV 80 -120% CCV 67 -133% Carryover blank: <QL IPR and OPR criteria per reference method	Inspect system, correct problem, rerun calibration and affected samples	Analyst	B-2
TOC Analyzer	Initial and continuing calibration per SOP	CCV each batch	ICAL linearity $r^2 \geq 0.995$ ICV +/- 10% true value CCV+/- 10% true value.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-13, C-16

[a] Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix C of the AECOM 2010 Water Column Monitoring QAPP.

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
Isotope Dilution Mass Spectrometry (PCDD/PCDFs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	A-1
HRGC/HRMS (PCB Congeners and Homologs)	Clean sources; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-6
HRGC/LRMS-SIM (PAH and Alkyl PAHs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-4
CVAFS (Mercury)	Replace disposables, flush lines	Sensitivity check	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	B-1, B-2
TOC Analyzer (TOC)	Replace disposables, clean quartz boat; oven thermometer calibration quarterly	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-13, C-16

[a] Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix C of the AECOM 2010 Water Column Monitoring QAPP.

QAPP Worksheet #26 (UFP-QAPP Manual Section 3.3.3) Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): CH2M HILL Field Team (see Worksheet #21 for a list of the sample collection methods)
Sample Packaging (Personnel/Organization): CH2M HILL Field Team
Coordination of Shipment (Personnel/Organization): CH2M HILL Field Team
Type of Shipment/Carrier: UPS or FedEx for overnight delivery or laboratory courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Custody and Storage (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Preparation (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Determinative Analysis (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples will not be stored in the field but will be shipped to the designated laboratory the same day as collection or no later than the day after collection. If circumstances require that the samples be stored in the field, they will be maintained under the method-specified conditions (e.g., kept at 4±2° C).
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Sample extraction and digestion holding times are summarized in Worksheet #19.
SAMPLE DISPOSAL
Personnel/Organization: Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services).
Number of Days from Analysis: Varies by laboratory; laboratory is required to give CH2M HILL 30 days notice prior to intent to discard any project samples.

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Final Evidence Files

Laboratory records including COCs and other sample receiving records, sample preparation and analysis records, and the final data package become part of the laboratory final evidence file and must be retained as required by the contractual agreement. An original copy of the data package and associated electronic deliverable must be provided to CH2M HILL in accordance with the contractual agreement and will be retained by CH2M HILL along with associated field records and other related correspondence.

Final evidence files as retained by CH2M HILL will include, but not be limited to, correspondence (paper and email), plans, contractual documents, maps and drawings, field data, calculations, assessment reports, laboratory deliverables, progress and data reports. This information will be maintained in a secure area according to the procedures outlined in the Lower Passaic River Restoration Project Quality Management Plan (AECOM, 2009).

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PCDD/PCDFs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	A-1
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Analytical Perspectives
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Labeled Compounds	Spiked into every sample and QC sample.	See reference method and SOP for compound specific control limits	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveal a problem. If S/N<10 for quantitation ion, re-prepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	See reference method and SOP for compound specific control limits
BCS_3	1/Batch	%D for RRF vs ICAL ≤ 20% except labeled	Reanalyze affected samples. Qualify data	Analyst/Section Supervisor	Accuracy/Bias	%D for RRF vs ICAL ≤ 20% except labeled

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

	(20 samples)	analogs ≤ 30%	as needed.			analogs ≤ 30%
Field Duplicate	To be submitted for analysis only if sufficient pore water volume is generated from one of the pore water composite samples.	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PCBs – Congeners and Homologs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-6
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compounds >QL
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
OPR Sample (equivalent to LCS)	1/Batch (20 samples)	50-150%R Toxics/LOC congeners; 40-160%R all other congeners	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias	50-150%R Toxics/LOC congeners; 40-160%R all other congeners

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Labeled Compounds	Spiked into every sample and QC sample.	30-140%R	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveal problem. If S/N<10 for the quantitation ion, re-prepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	30-140%R
Field Duplicate	To be submitted for analysis only if sufficient pore water volume is generated from one of the pore water composite samples.	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PAHs and Alkyl PAHs (LRMS-SIM)
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-4, T-3
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Prep Batch (≤20 samples)	No target compounds >QL.	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL.
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Labeled Compounds	Every sample	60-140%R in MB & LCS 30-120%R in field samples	Check calculations. Ensure that instrument performance is acceptable. If signal/noise (S/N) ratio <10, re-prepare and reanalyze sample. If S/N ratio >10, flag data	Analyst/Section Supervisor	Accuracy/Bias	60-140%R in MB & LCS 30-120%R in field samples
LCS	1/Prep Batch (≤20 samples)	60-140%R	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	60-140%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Duplicate	To be submitted for analysis only if sufficient pore water volume is generated from one of the pore water composite samples.	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Metals: Mercury (total and dissolved), Low Level
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	B-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Brooks Rand, LLC
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	3/Batch (20 samples)	Average MB <2x MDL and standard deviation <0.67x MDL or <0.1x the concentration of project samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	Average MB <2x MDL and standard deviation <0.67x MDL or <0.1x the concentration of project samples
LCS	1/batch	80 -120%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	80 -120%R
CRM	1/Batch (10 samples)	Within 25% of certified value	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Within 25% of certified value
Laboratory Duplicate	1/Batch (10 samples)	RPD ≤24%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤24%
MS	1/Batch (10 samples)	71-125% R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	71-125% R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

MSD	1/Batch (10 samples)	≤24% RPD	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	≤24% RPD
Field Duplicate	To be submitted for analysis only if sufficient pore water volume is generated from one of the pore water composite samples.	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Metals: Methyl Mercury (total and dissolved)
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	B-2
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Brooks Rand, LLC
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	Minimum of four MBs with each batch (10 samples)	Average MB ≤0.045 ng/L and standard deviation ≤0.015 ng/L or <0.1x the concentration of project samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	Average MB ≤0.45 ng/L and standard deviation <0.15 ng/L or <0.1x the concentration of project samples
CRM	1/Batch (10 samples)	Within 35% of certified value	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Within 35% of certified value
Laboratory Duplicate	1/Batch (10 samples)	RPD ≤ 35% (or ±QL if results are ≤5x the QL)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤ 35% (or ± QL if result is ≤5x the QL)
MS	1/Batch (10 samples)	65-135%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias-Precision	65-135%R
MSD	1/Batch (10 samples)	≤35% RPD	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	<24% RPD

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Duplicate	To be submitted for analysis only if sufficient pore water volume is generated from one of the pore water composite samples.	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry – TOC and DOC
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-13, C-16
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS-Kelso
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	<QL
LCS	1/Batch (20 samples)	95-105%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	95-105%R
LCSD	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Inorganic Carbon Spike	1/Batch (20 samples)	≤110% of the unspiked sample	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	≤110% of the unspiked sample
MS	1/Batch (20 samples)	80-120%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	80-120%R
MSD	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Duplicate	To be submitted for analysis only if sufficient pore water volume is generated from one of the pore water composite samples.	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table

Project Document Control System

Project documents are controlled by CH2M HILL's Project Manager who will maintain and manage hardcopies and electronic copies of all project related documents according to the Lower Passaic River Quality Management Plan (AECOM, 2009). Electronic copies of all information relating to this project are maintained on the project network files which are backed up at least once per day; access to these files is limited to authorized project personnel. All project data and information must be documented in a standard format which is usable by all project personnel.

Data Quality Assurance Procedures

Sediment Sampling: CH2M HILL will monitor the progress of sediment sample collection to verify that samples are collected as planned. The progress of sample collection and processing will be monitored through the documentation of samples collected and shipped each day. The participating laboratories must maintain a formal QA Plan to which they adhere and which addresses all data generating aspects of daily operations. A policy of continuous improvement will allow all data generation processes to be reviewed and modified as needed to meet project objectives. Periodic audits of field and laboratory operations will ensure that data collection, documentation and QC procedures are being followed.

Laboratory Data Transmittal

Laboratory data are managed by the laboratory's LIMS beginning with the sample receiving process. Laboratories are required to provide validated data reports (sample results, QC summary information, and supporting raw data) including EDDs within the turnaround times specified in Worksheet #30. EDDs will be provided to de maximis, inc. in an Earthsoft EQuIS® four-file format. All EDDs will be checked prior to transmittal to de maximis, inc. using current versions of Earthsoft's Electronic Data Processor (EDP).

Data Storage and Retrieval

Completed forms, logbooks, photographs, data packages, and electronic files will be transmitted regularly to the Project Manager. Each laboratory will maintain copies of all documents it generates as well as backup files of all electronic data relating to the analysis of samples. Raw data and electronic files of all field samples, QC analyses and blanks must be archived from the date of generation and maintained by each laboratory in accordance with the terms of the contract between CH2M HILL and the laboratory. Project closeout will be conducted in accordance with contractual guidance. As required by the Settlement Agreement all data and other project records will be made available to USEPA.

Data transfer to USEPA will include a Multi-media Electronic Data Deliverable (MEDD) that conforms to the 2007 EPA Region 2 MEDD format. The MEDD will include all qualified and rejected data (including the reported, numerical value for rejected data).

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time	Laboratory/ Organization	Backup Laboratory/ Organization
Water	PCDD/PCDFs	Low	All	A-1	45 days	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Todd Vilen 910-794-1613	Test America 880 Riverside Parkway West Sacramento, CA 95605 David Alltucker 916.374.4334
Water	PCBs (Homologs and Congeners)	Low	All	T-6	45 days	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	Analytical Perspectives 2714 Exchange Dr. Wilmington, NC 28405 Bryan Vining 910.794.1613 bryan.vining@sgs.com Phillip Hanna phillip.hanna@sgs.com
Water	PAHs –LRMS SIM	Low	All	T-4	45 days	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Water	Low Level Mercury (total and dissolved)	Low	All	B-1	30 days	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206-632-6206	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222
Water	Methyl Mercury (total and dissolved)	Low	All	B-2	30 days	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206-632-6206	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Water	TOC/DOC	Low	All	C-13	30 days	TestAmerica 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIa	Field SOPs, field records	Verify conformance to approved sampling and field measurement procedures; ensure that activities met performance criteria; and verify that deviations from procedures or criteria were documented.	Mark Stinnett, Project Chemist/ CH2M HILL
IIa	Analytical data deliverables, contractual documents	Verify the required deliverables, analyte lists, method holding times, analytical procedures, laboratory qualifiers, measurement criteria, and project quantitation limits conform to specifications. Verify that deviations from procedures or criteria were documented.	Mark Stinnett, Project Chemist/ CH2M HILL
IIa	Field records, database output	Verify transcription of field data from field forms to database.	Mark Kill, Data Management Task Manager/ddms
IIa	Custody records, analytical data reports	Review traceability from sample collection through reporting.	Mark Stinnett, Project Chemist/ CH2M HILL
IIa	Laboratory EDDs, analytical data reports, database output	Verify EDDs against hard-copy analytical reports.	Mark Kill, Data Management Task Manager/ddms
IIa	Data validation reports, database output	Verify that entry of qualifiers was correct and complete.	Mark Kill, Data Management Task Manager/ddms
IIb	Analytical data reports	Verify that reported analytes, holding times, analytical procedures, measurement criteria, and project quantitation limits conform to the QAPP. Verify that deviations from procedures or criteria were documented.	Mark Stinnett, Project Chemist/ CH2M HILL
IIb	Analytical data reports, validation guidance	One hundred percent of the data will be validated (see details below).	Mark Stinnett, Project Chemist/ CH2M HILL
IIb	QAPP, analytical data reports, validation guidance	Verify that the qualifiers applied during validation were in conformance with the QAPP and specified validation guidance.	Mark Stinnett, Project Chemist/ CH2M HILL

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

IIb	Analytical data reports	Verify that PE samples were analyzed at the frequency specified in the QAPP and met the acceptance criteria.	Not Applicable to QAPP Addendum D
IIb	QAPP, data validation reports	Verify that data validation was performed in accordance with the QAPP specifications and that all required peer reviews were conducted. If validation actions deviated from the QAPP specifications and/or regional validation guidance based on professional judgment, verify that rationale was documented.	Mark Stinnett, Project Chemist/ CH2M HILL

Data Validation

Validation of each analytical group will be limited to the target analytes listed in Worksheet #15 for that group. At a minimum, 100% full validation (includes review of raw data and spot check for verification of calculations) will be conducted for PCDD/PCDFs (the 2,3,7,8-substituted Congeners and Homologs listed in Worksheet #15), all 209 PCB Congeners and Homologs, OC Pesticides, PAHs and Alkyl PAHs, mercury and methyl mercury for each sample delivery group (SDG). For all other parameters, 100% full validation (as appropriate to the analyses) will be performed on the first SDG. The remaining SDGs will be subject to full validation for every fifth SDG, and limited validation for the remaining SDGs.

Limited validation will be based on information provided by the laboratory on their QC forms, and will include no or minimal raw data review. At a minimum, limited validation will include the following data elements:

- Agreement of analyses conducted with COC requests
- Holding times and sample preservation
- Initial and continuing calibrations and analytical sequence
- Mass spectrometer tuning (GC/MS only)
- Internal standard performance (GC/MS only)
- Laboratory blanks/equipment blanks
- Surrogate recoveries
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- Laboratory duplicate results (if generated)

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

- Field duplicate results (if generated)
- Interference check sample (ICS) results (AB solution only)
- Inductively Coupled Plasma (ICP) serial dilution results
- Percent solids
- Quantitation limits and sample results (limited to evaluating dilutions and reanalyses)

If significant issues (e.g., those affecting achievement of the DQOs) are noted during full validation, the limited validation will be expanded to include this issue. Systematic or random errors that would not be detected during a review of the summary forms might include, for example, misidentification or quantitation of compounds, transcription errors, or calculation errors. In addition, limited validation will provide review of key laboratory QC elements, which would highlight potential underlying lab issues which may require further investigation (i.e., full validation effort). If a high frequency of measurement performance issues are found, the issues will be investigated and an additional validation effort may be implemented. CH2M HILL plans to maintain communication/notification systems with the laboratory during the analytical process to circumvent significant QC issues. If QC issues do arise, investigations and corrective actions will be documented and implemented in a timely fashion to optimize the amount of un-qualified data.

In addition, data packages receiving limited validation will receive a completeness check so that full validation could be performed at a later data, if necessary. The check will verify that the raw data for each sample (including all reanalyses and dilutions) are present and complete. The data supporting the sample results, such as QC samples (method blanks, LCS, MS/MSD), calibrations, tunes, and preparation logs, will also be reviewed for overall completeness, however, an in-depth inventory to ensure specific association with all sample data will not be performed.

Validation qualifiers will be applied based on the criteria in the QAPP, method-specific Region II validation SOPs, or professional judgment. These qualifiers include “U”, “UJ”, “N”, “NJ”, “U”, and “R”, as defined in the Region II validation SOPs.

Reports summarizing data qualification as a result of the validation effort will be prepared.

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
CH2M HILL's data validation subcontractor will validate all laboratory data in accordance with the process and protocols described in Worksheet #35 of this document and Worksheet #36 of the RM 10.9 QAPP. The Project QA Manager, in conjunction with the project team, will determine whether the analytical data meet the requirements for use in making decisions related to further actions at the site. The results of laboratory measurements will be compared to the DQOs described in Worksheet #11 of this document.

Describe the evaluative procedures used to assess overall measurement error associated with the project:
During the data validation process the validator will use information confirming sample identification; sample preparation; analysis within holding time; instrument calibration data; and results of QC samples designed to assess blank contamination, analytical precision, and accuracy to identify any limitations in data use and, if known, data bias. The validator will apply qualifiers as needed to reflect any limitations on the use of specific data points and prepare a report detailing the information reviewed, data limitations, and overall usability. Patterns of data use limitations or anomalies which become apparent during the validation process or as the users will be reviewed with the Project QA Manager and the appropriate laboratory. Data that do not meet the quality acceptance limits of Worksheet #28, or quality levels of Worksheet #15, or analytical performance criteria specified in Worksheet #12 will be clearly identified in the database so data users are aware of any limitations associated with data usability. Details of the problems identified during data validation and the bias in the data will be provided in the associated validation memorandum.

Identify the personnel responsible for performing the usability assessment:
Data validation will be performed by CH2M HILL's data validation subcontractor. The usability assessment will be performed jointly by the CH2M HILL and CPG project teams and will include input by field personnel, QA staff, and project management.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:
The documentation generated during data validation will include a comprehensive memorandum that describes the information reviewed, the results of this review and provides a recommendation on overall data usability and limitations on specific data points. The memorandum and associated validation worksheets provide information on the samples included in the review and the date they were collected; the condition of samples when received at the laboratory and any discrepancies noted during the receiving process; verification of sample preparation and analysis within the method specified holding time; instrument calibration information; review of associated QC analyses including blanks, LCS, and field and/or laboratory duplicates; verification of selected reported values from raw data. As a result of this review standard qualifiers are entered into the database so that data users can readily identify any limitations associated with a specific data point.

Appendix A

Laboratory Standard Operating Procedures